Vol. I JANUARY, 1918 No. 11

LIBRARY
BOSTON UNIVERSITY
SCHOOL OF MEDICINE

THE AMERICAN REVIEW OF TUBERCULOSIS

JOURNAL OF

THE NATIONAL ASSOCIATION FOR THE STUDY AND PREVENTION OF TUBERCULOSIS

EDITORIAL STAFF

EDWARD R. BALDWIN, Saranac Lake, N. Y.
Editor-in-Chief

LAWRASON BROWN, Saranac Lake, N. Y.
H. R. M. LANDIS, Philadelphia, Pa.
PAUL A. LEWIS, Philadelphia, Pa.
M. J. ROSENAU, Boston, Mass.
HENRY SEWALL, Denver, Col.
BORDEN S. VEEDER, St. Louis, Mo.

ALLEN K. KRAUSE, Baltimore, Md.
Managing Editor

PUBLISHED MONTHLY

AT 2419-21 GREENMOUNT AVE., BALTIMORE, MD.

BY THE NATIONAL ASSOCIATION FOR THE STUDY AND PREVENTION OF TUBERCULOSIS

Entered as second class matter March 9, 1917, at the post office at Baltimore, Maryland, under the Act of August 24, 1912

Copyright 1918 by The National Association for the Study and Prevention of Tuberculosis

"To be certain—burn-it-all"

Superior Advantages of Our No. 5 Sputum Cups

1. You can burn entire cup.
2. Cups are constructed along expert lines with aid of prominent physicians.
3. Easily removed from holder.
4. Holder of superior quality and ease of use.
5. Packed in dust-proof carton, 20 to box.
6. All goods carefully inspected for quality.
7. Prices are right.

Other Burnitol Products

Sputum Cups, flat and wire-stitched

Sputum flasks	Paper towels
Sputum test boxes	Paper drinking cups
Paper cuspidors	Absorbent gauze
Toilet papers	Absorbent cotton

Waxed bags, etc., etc.

Write for Samples and Price List

BURNITOL MANUFACTURING CO.

37 No. Market Street
CHICAGO, ILL.

Everett, Station
BOSTON, MASS.

Announcement of the Fourth Session

of the

TRUDEAU SCHOOL OF TUBERCULOSIS

June 14 to July 26, 1918

A six weeks' course of instruction in the advanced study of tuberculosis will be given to a limited number of physicians or under-graduates. Clinical and laboratory facilities especially for diagnosis and treatment of incipient cases in various sanatoria. Course includes comprehensive study of tuberculosis history, pathology, diagnosis and treatment

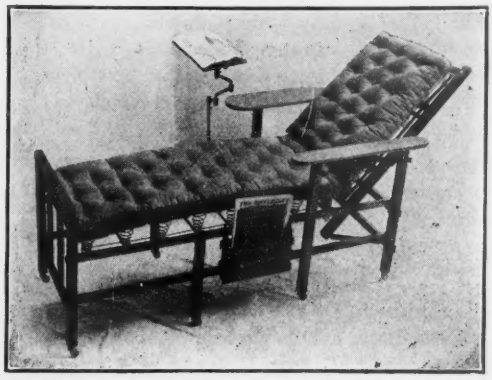
Special instruction in x-ray methods and interpretation, the complement fixation test, tuberculin and artificial pneumothorax, sanatorium organization and management.

Fee $100

Scholarships offered to a limited number

For prospectus of course and other information address

Secretary, Trudeau School **Saranac Lake, N. Y.**



The "Rondack"

COMBINATION

Couch *and* Chair

Complete With Magazine Rack

$19.50

Finished Regularly
Natural or Moss Green

Indispensable for sitting, reclining and sleeping outdoors.

Adjustable to eleven positions by occupant, while sitting.

Fitted with ball bearing casters. Can be easily moved about when occupied.

The 56 steel coil springs inure luxurious comfort and rest.

With fine twill green denim two piece cushion tufted, cotton filled, 3½ inches thick, crated ready for shipment.

With two piece khaki covered tufted silk floss cushion, 3½ inches thick, **$22.50.** Adjustable Reading Rack, **$5.50** extra.

We ship set up ready to use when uncrated, because it costs no more for freight or express. Saves the purchaser the expense of assembling.

Highly indorsed by leading physicians for tuberculosis patients and convalescents.

Weight crated 100 pounds.

Satisfaction Guaranteed or Money Refunded
Our 1918 Catalogue Sent Free on Request

GEORGE L. STARKS & CO. 96 Broadway Saranac Lake, New York

Associate Editors

Robert H. Babcock
Chicago, Ill.

W. Jarvis Barlow
Los Angeles, Cal.

Hermann M. Biggs
New York, N. Y.

Rupert Blue
Washington, D. C.

S. G. Bonney
Denver, Col.

Vincent Y. Bowditch
Boston, Mass.

Walter Brem
Los Angeles, Cal.

Philip King Brown
San Francisco, Cal.

George E. Bushnell
Fort Bayard, New Mex.

John W. Churchman
New Haven, Conn.

Hoyt E. Dearholt
Milwaukee, Wis.

Lydia M. DeWitt
Chicago, Ill.

H. Kennon Dunham
Cincinnati, Ohio

Livingston Farrand
Boulder, Col.

A. H. Garvin
Ray Brook, N. Y.

Louis Hamman
Baltimore, Md.

John B. Hawes, 2nd
Boston, Mass.

Henry Barton Jacobs
Baltimore, Md.

Arnold C. Klebs
Washington, D. C.

S. Adolphus Knopf
New York, N. Y.

George M. Kober
Washington, D. C.

E. Libman
New York, N. Y.

John H. Lowman
Cleveland, Ohio

David R. Lyman
Wallingford, Conn.

George Mannheimer
New York, N. Y.

Thomas McCrae
Philadelphia, Pa.

O. W. McMichael
Chicago, Ill.

Alfred Meyer
New York, N. Y.

James Alex. Miller
New York, N. Y.

Charles L. Minor
Asheville, N. C.

Roger S. Morris
Cincinnati, Ohio

Eugene L. Opie
St. Louis, Mo.

Edward O. Otis
Boston, Mass.

George T. Palmer
Springfield, Ill.

William H. Park
New York, N. Y.

Francis W. Peabody
Boston, Mass.

Richard M. Pearce
Philadelphia, Pa.

Joseph H. Pratt
Boston, Mass.

Mazÿck P. Ravenel
Columbia, Mo.

Samuel Robinson
Rochester, Minn.

Leonard G. Rowntree
Minneapolis, Minn.

Theobald Smith
Princeton, N. J.

Walter R. Steiner
Hartford, Conn.

Gerald B. Webb
Colorado Springs, Col.

William H. Welch
Baltimore, Md.

William Charles White
Pittsburgh, Pa.

Gordon Wilson
Baltimore, Md.

M. C. Winternitz
New Haven, Conn.

CONTENTS

JOSEPH H. PRATT: The Importance of Prolonged Bed Rest in the Treatment of Pulmonary Tuberculosis 637

F. W. WITTICH: A Comparison Between the Skin Tests, Using Various Tuberculosis Antigens, and the Complement Fixation Phenomenon 654

BERNICE W. BILLINGS and JOHN B. HAWES, 2ND: Are Sanatoria Worth While 663

ALFRED F. HESS: A Tuberculosis Preventorium for Infants 669

WILLARD BOYDEN HOWES: Animal Experiments in Immunity and Treatment of Tuberculosis With Cell Poison Obtained From Sputum 674

Editorial 680

Medical Notes, Abstracts and Reviews 683

THE AMERICAN REVIEW OF TUBERCULOSIS is issued monthly about the 20th of the month. Each volume consists of approximately 700 pages. The volumes begin with the March number.

The subscription price of the REVIEW to members of The National Association for the Study and Prevention of Tuberculosis is $2.00 per volume, and to non-members of the National Association, $3.00 per volume. Twenty-five cents extra should be added for Canadian and fifty cents extra for foreign postage. Subscriptions may be sent to 2419 Greenmount Avenue, Baltimore, Md., or to The National Association for the Study and Prevention of Tuberculosis, 105 East 22d Street, New York City. Checks should be made payable to William H. Baldwin, Treasurer.

Manuscripts should be sent to the office of the Managing Editor, Dr. Allen K. Krause, Johns Hopkins Hospital, Baltimore, Md. Manuscripts should be typewritten on one side of the page only. The publishers will not be responsible for manuscripts lost in transit. In order to save expense for authors' corrections in proof, the manuscripts should be carefully revised by the authors before submission.

Fifty reprints of articles will be furnished to contributors free of charge when requested in advance. A table showing cost of additional reprints, with an order blank is submitted with proofs to the author.

Advertising rates will be sent on request. The publishers reserve the right to decline any advertising submitted and to censor all copy.

The price of single copies of THE AMERICAN REVIEW OF TUBERCULOSIS is thirty-five cents.

B-D SARANAC

If Price Consideration Offers an Influence

when you are selecting your Clinicals, it may warp your better judgment.

The all important element for consideration is, Permanent Accuracy.

B-D Saranac Clinical Thermometers are guaranteed permanently accurate, and in purchasing this particular clinical you pay for the intrinsic value which its quality represents but far less than its worth to you.

The **B-D** Saranac fulfills the exacting demands of Tubercular patient therapy.

Becton, Dickinson & Co.

Rutherford **New Jersey**

B-D SARANAC

THE IMPORTANCE OF PROLONGED BED REST IN THE TREATMENT OF PULMONARY TUBERCULOSIS[1]

JOSEPH H. PRATT

Boston

The treatment of pulmonary tuberculosis as generally carried out in this country is yielding poor results. Something is radically wrong. It is time that physicians and social workers awoke to a realization of this fact.

Dr. Louis Hamman (1) who, as director of the Phipps Tuberculosis Dispensary of the Johns Hopkins University, has had extensive experience, wrote as follows in 1915: "To put the matter briefly the tuberculosis campaign of the past fifteen years has taught us two important lessons: first, that the tuberculous cannot be isolated in their homes; second, that they cannot be cured in or out of sanatoria."

This startling statement, which was doubtless based largely on personal observations made in Baltimore, is apparently borne out by statistics published by Edward Hochhauser (2), executive secretary of the Joint Tuberculosis Committee of New York City. An investigation was made of patients discharged from one institution during a period of three years. Taking only those discharged arrested or improved, that could be traced, approximately 45 per cent died or were worse, 47 per cent were stationary, and only 8 per cent were better. "These facts," says Hochhauser, "are not peculiar to this particular institution but are fairly typical of sanatoria that treat men and women of a like wage-earning group."

A similar poor showing is made by the Massachusetts state sanatoria. Of the patients discharged from these institutions two to five years ago only 30 per cent are working (Hawes (3)). From the official report (4) of the trustees of the Massachusetts state sanatoria for 1916, it is learned that out of 1456 patients admitted during the year 224 died. That is 15 per cent. Cases that were deemed hopeless were not received. Furthermore, in only 24 per cent of the patients was the

[1] Read before the Section on Practice of Medicine at the Sixty-eighth Annual Session of the American Medical Association, New York, June, 1917.

disease arrested or apparently arrested during their stay in the sanatorium.

If the results of sanatorium treatment for wage-earners are bad, those obtained in dispensary and private practice are worse, as every tuberculosis worker knows. Throughout the country thousands of cases are treated each year in tuberculosis dispensaries, but no reports are published, and this is doubtless because recoveries are rare.

Until the middle of the last century all medical authorities were agreed that if the diagnosis of consumption was correctly made there was little hope of cure. Wise physicians admitted that the recoveries which rarely occurred were due more to chance than to the methods of treatment employed. The diagnosis was withheld as long as possible from the patient, because in that disease, as Sir Thomas Browne (5) had said, medical predictions did not fail, and it was as dangerous to be sentenced by a physician as a judge. Treatment consisted largely of attempts "to smooth the pillow of the patient dying of consumption" (6).

The man who first treated consumption successfully was Hermann Brehmer (7). So convinced were medical men of that period that consumption could not be cured that when Brehmer claimed success, he was regarded as a charlatan. Although for more than thirty years Brehmer continued to demonstrate the possibility of cure in this disease, he died before his work had gained wide acceptance.

I wish to point out what I think has not been recognized, that Brehmer's success was due to the employment of rest in the treatment of consumption. Brehmer is always regarded as an advocate of exercise as the means of cure, and so he was. He believed in exercise but his treatment, as I shall show, was in reality a modified rest treatment. There can be little doubt that the patients obtained more rest in the fresh air when they followed his rules than did the patients of any other physician of his time or of any earlier time.

He built his sanatorium on the lowest spot of a mountain valley so that all paths that led to it could be so made that there was a gentle down grade. He did this in order to diminish the chance of patients tiring themselves while walking. The last half of any walk which any patient took was thus made at an expenditure of less strength than the first half.

Miles of pleasant walks through the forest were constructed and along the sides of the paths were benches only twenty paces apart. Patients were instructed to walk slowly and never to walk so fast as to become at

all breathless. They were to stop and rest before they were tired, and never to resume their walk until they felt rested. If there was any chance that fatigue might result from continuing the walk for even a few steps they were to drop on the nearest bench even if it were already occupied by some one not congenial to them.

At night they were to feel as if they had taken no exercise. So carefully were Brehmer's instructions carried out that he said that only one patient among 13,000 suffered from overexertion. This was a physician who, while disobeying the rules, was caught in a thunder storm. After hurrying over a mountain path, he had a severe hemorrhage and died three days later. There can be little doubt in the light of present knowledge that Brehmer did injure many of his patients by mountain walks in spite of his care to prevent overexertion.

Brehmer did not allow patients to do any work with their arms. He recognized that pulmonary gymnastics were injurious. Card playing and billiards were forbidden. He did not allow patients to walk when their temperature was elevated.

Dettweiler (8), first a patient and later an assistant of Brehmer, is regarded as the originator of the rest treatment. He introduced the use of prolonged rest in reclining chairs. He constructed resting halls open on one side and here were placed comfortable adjustable chairs of his own invention. These *chaises-longues* were made of rattan and upholstered with horse hair. Most of the patients without fever spent from seven to eleven hours in their chairs daily. It was the exposure to the open air to which he attributed improvement rather than the rest to the lungs and body. In fact, Dettweiler used breathing exercises. Although Dettweiler used enforced rest, he seems to have placed less restriction on exercise during the free hours than did Brehmer. It is possible that Dettweiler's patients were not so carefully guarded against fatigue and according to his own statements (9) he had cases of injury from overexertion every year in his sanatorium. Dettweiler seems to have been the first to employ "absolute rest" in combating the fever of phthisis. He recognized that it was of more value than any other form of treatment. For this he deserves great credit.

It is evident that both pioneers used a modified rest treatment. They presented to the world strong evidence that consumption is curable. In 1885, Brehmer treated seventy-three first stage patients with tubercle bacilli in their sputum. Fourteen of these or 19 per cent were discharged with the disease apparently cured and with their sputum

free from bacilli for five weeks (10). In 1886, Dettweiler (11) published a detailed report on seventy-two patients that had been well from three to nine years.

Edward L. Trudeau (12) learned of the work of Brehmer and Dettweiler as early as 1882 from articles that appeared in the *Practitioner*, an English journal. In his autobiography he says that he was much impressed with what he read, and though he saw no reference to either Brehmer's or Dettweiler's work in American journals he became desirous of making a test of this new method, "the essence of which was rest, fresh air, and a daily regulation by the physician of the patient's life and habits."

Trudeau, inspired by what he had learned, and moved by the desire to help the sick poor of the cities, planned, with the approval of Dr. Alfred Loomis, the Adirondack Cottage Sanitarium, which was opened in February, 1885.

Dr. Trudeau's experience with the new method made him a firm advocate of the rest treatment for the remainder of his life. Let me quote from a letter he wrote me in 1911:

> I was one of the first, if I remember, to advocate the rest cure, and for many years had to stand my share of abuse about it. I remember distinctly getting up in medical meetings and being sat upon on all sides by the gentlemen who said "rest was very well, but how was a consumptive to keep up his appetite unless he exercised?" Then my own men here did not believe in it at first, and it took some time for them to accept the fact that the best way to treat a tuberculous process which shows any degree of activity is by rest. At any rate, I want you to know that I have always been thoroughly in favor of rest, and that even now I find myself standing out against the new doctrine of curing people by exercise. I cannot help but feel that although, of course, there are cases that are much benefited especially by graded exercise, the fact still remains that when a tuberculous process shows any degree of activity rest is the safest plan to follow. I know I have hurt nobody by rest, but I am quite sure I often have by allowing them to exercise. Perhaps this was due to want of caution on my part, but I should say, as I always have, when in doubt it is safer to rest your patient, and I know in this you will agree with me.

While speaking of the introduction of the rest treatment into this country, mention should be made of Kretzschmar (10) of Brooklyn who, in 1888, ignorant of Trudeau's work, published in the *New York Medical Journal* an excellent account of Dettweiler's method of treating

pulmonary consumption. He urged that a properly situated sanatorium be erected near New York that "this very simple and still so effective mode of treatment" might be introduced. This was probably the first description of the work of Brehmer and Dettweiler to be published in America.

The importance of rest was more fully recognized by the men who came after Dettweiler. Especial mention should be made of Turban (13), Cornet (14), and Penzoldt (15) (16), who did much by their writings to extend the rest treatment in Germany. In fact, in France it has been called the German method (17). The rarity of resting halls in American sanatoria and the fact that his book on treatment was never translated into English indicate that here the influence of Dettweiler was slight, in spite of the fact that his method was early adopted by Trudeau and the Saranac school, Minor (18) of Asheville, and a few others.

For a good many years the treatment generally advocated in America was exercise in the open air. In the sixth edition of Austin Flint's Practice (19), published in 1886, the statement is made that "exercise in the open air—or, as I should prefer to say, out-of-door life—is, of all measures, the most important." Twelve years ago, at about the time public sanatoria began to be established, the work treatment was first used in England and quickly spread to this country. It is important to trace the development of this movement. Although Walther of Nordrach was almost the only one in recent times in Germany to advocate rigorous exercise as a means of cure, he had a large following in England. There was no statistical evidence to prove that it yielded as good results as the rest treatment of Dettweiler, but probably because of the Englishman's deep-rooted belief in the health-restoring power of exercise, Walther's views were adopted and Dettweiler's rest cure rejected without subjecting either to careful tests.

Paterson (20) of the Brompton Hospital Sanatorium, in addition to the long walks advocated by Walther, employed graduated labor as a therapeutic measure. He treated patients on the theory that the course of pulmonary tuberculosis was favorably influenced by "auto-inoculations" induced by labor. To carefully selected patients graduated work of different grades was given. It was his aim "to increase the patient's labor—in so far as was consistent with his physical capacity—in order to produce a marked deviation in the temperature on one or another of the grades and finally enable him to do five hours' hard outdoor work with little deviation."

Paterson supervised his patients carefully and whenever symptoms of auto-inoculation developed, immobilization in bed was maintained until they disappeared. In spite of the selection of cases and the close supervision of the work the end results published in 1914 were disappointing, as even those in charge of the work admitted (21).

The studies of Barnes (22) of the Rhode Island Sanatorium indicated that the mild febrile auto-inoculations were injurious rather than beneficial. He found that the fewer the fever days the better the chance of recovery, and made the important observation that patients who had occasional auto-inoculations relapsed more frequently than those who had no periods of fever while under treatment.

The great majority of Paterson's patients had had three months of treatment in the wards of the Brompton Hospital. Only those patients were chosen "who were free from fever or other serious constitutional symptoms, who possessed considerable vitality and who had already begun to show signs of improvement" (21).

Before therapeutic "auto-inoculations" had been well tested clinically and in spite of the fact that injury from the febrile reactions had been often observed, the theory was favorably received in this country. Graduated labor as a means of cure has been widely employed here without the restrictions and safeguards imposed by Paterson. In some American sanatoria patients with active disease are put to work within two weeks of their admission. Few have heeded Lawrason Brown's warning that the treatment is "fraught with grave peril" (23).

Even Brehmer restricted the activities of his patients, in other words, employed more rest, than do those in charge of many American sanatoria today. This statement may be doubted. Some may say that the importance of strict rest is common knowledge, and that the rest treatment is properly carried out in nearly all of our sanatoria. I have been collecting information on this point from patients who have been in the public sanatoria. Fourteen out of twenty-four patients with active disease who later consulted me were allowed to walk, according to their statement, an unlimited distance within two weeks after their admission. They were told nothing of the danger of overexertion. In none of these cases was Dettweiler's resting treatment employed.

Nothing could indicate more clearly the failure to recognize the importance of rest by those in charge of the tuberculosis campaign than a pamphlet on tuberculosis issued by the New York State Department

of Health (Circular 21, 1916 edition) for general distribution. Under the heading of "How to treat and cure tuberculosis" occurs the following statement: "The treatment of tuberculosis consists in properly directed rest and exercise, plenty of fresh air, the care of the skin, and a sufficient amount of good, wholesome food." A little lower down on the same page is this sentence: "It is well to rest for half an hour, or if possible a little more, before and after each meal."

This is all the instruction contained in this pamphlet regarding rest. Doubtless it had been read and approved before publication by men who are prominent in phthisiotherapy. Even a patient with fever taking this as his guide would exercise. If he rested "a little more" than half an hour before and after meals he would think that he was carrying out the appropriate treatment. Brehmer, as I have pointed out, gave safer instructions than this to his patients over fifty years ago.

In the latest edition of the American Red Cross textbook on elementary hygiene and home care of the sick, which is being widely read at the present time (seven reprintings in 1917 to date), there is a section on the diagnosis and early treatment of tuberculosis in which rest is not mentioned. The reader is told that "a dry climate and an out door life with abundant, nourishing food cover the special treatment."

For a period of about eighteen months beginning in 1905 I followed the Dettweiler form of rest treatment. For the past ten years I have employed prolonged rest in bed even in afebrile cases, and the use of the reclining chair has been largely abandoned.

My observations have been made on three types of cases: 1. The sick poor who have been treated in their homes. 2. Private patients who have been treated in their homes. 3. Private patients treated in a small sanatorium at Lunenburg, Mass. As the strict rest treatment has been carried out with the patients in bed, this institution would be more properly termed a hospital than a sanatorium.

With the patient in bed out of doors, easy in his mind and convinced that the treatment is the one that will give the best and the quickest results, improvement in favorable cases is usually rapid and continuous. The results obtained among the sick poor are given below. I do not wish to convey the impression that I now stand alone in the employment of rest in bed in afebrile phthisis. For several years L. Brown (23) has advocated an initial period of six weeks' rest in bed, and I know a few other men who for several years have used prolonged rest in bed in their afebrile cases.

REST AS A MEANS OF CURE IN PULMONARY TUBERCULOSIS

Surgeons and laryngologists have long recognized that in tuberculosis of the joints and larynx immobilization of the affected part promotes healing. What would one think of a surgeon who in treating a tuberculous knee joint advised graduated exercise?

The studies of Tendeloo (24) give a scientific explanation for the beneficial action of rest in pulmonary tuberculosis. He found that a diminution of the respiratory movement of the lungs exerts a healing influence. If the tuberculous lung tissue is brought to complete rest, then the lymph flow through the tuberculous area falls nearly to zero or even completely to zero. By this means the supply of nutrient material to the area is shut off and tuberculous toxins and products of disintegration accumulate in it, until finally the growth of bacilli and the production of toxin ceases.

Rubel (25) has furnished experimental evidence of the value of functional rest to the lung in tuberculosis. After immobilizing a lung in rabbits by an operative procedure, he infected the animals intravenously. The tuberculous process was more benign and of more chronic character in the lung kept in a state of comparative rest than in the freely moving lung.

Much has been written about increasing the resistance of the patient by various therapeutic measures, without there being apparently any definite idea in the minds of the writers of how this increase is brought about. A. K. Krause (26) has clearly shown that the body increases its resistance by building up a mechanical barrier which it interposes between itself and the tubercle bacillus. Krause says:

> By complete rest we put the lungs in as complete circulatory inactivity, relatively speaking, as possible; and we do raise the patient's resistance, but we do this in a mechanical way by striving to avoid any maneuver that will enhance the circulation in the lung and in the tissue around the tubercle.

The need of keeping the lungs at rest in order to promote healing is the basis of the rest treatment. Absolute rest for the lungs is of course impossible but rest to the body and rest to the mind greatly lessens the work of the lungs and diminishes the blood flow through them. It takes a long time for firm scar tissue to form; hence, according to the severity and extent of the disease, months or years must elapse after the development of a fresh tuberculous process before pulmonary exercise can be taken without danger.

Injury from exercise cannot always be detected no matter how careful is the supervision, until it is too late to prevent renewed activity in the diseased area or a spread of the disease to other parts of the body. Herein lies the greatest danger from exercise in this treacherous disease. This tendency of the disease to "light up" without warning furnishes an additional reason for a long continued period of rest until sufficient time has elapsed for the defensive wall of scar tissue to become thick enough to protect the human host against the tubercle bacillus.

It is evident that if the above statements are true, the more complete the rest the shorter the duration of treatment and the greater the probability of recovery. Is it not reasonable then that rest in bed is indicated in every case of active tuberculosis because the maximum rest can only be obtained in bed?

THE METHOD OF BED REST[2]

At the outset the importance of complete rest is carefully explained to the patient. If he is made to realize that it gives quicker and surer results he will often take up the treatment cheerfully. He must feel confident that he is following the wisest course. I rarely have difficulty in inducing a patient to go to bed if his doubts and fears are set aside. One can promise with confidence that rest will act favorably on appetite and digestion, and that there will be a gain rather than a loss of strength. With a laxative diet a regular action of the bowels can be maintained without the use of drugs. The advantages and importance of rest are admirably set forth by Lawrason Brown (27). It is a good plan to have this chapter read to patients at the beginning of treatment.

The bed should be placed out of doors, and if necessary a porch should be constructed. The meals are eaten in bed. In cold weather the bed is rolled into a warm room adjoining the porch at meal time. The morning bath is given by a nurse or attendant. Most of my patients have been kept in the recumbent position, but it is possible that a semirecumbent position is preferable, as it has been shown that the gaseous metabolism is lower, and that there is less inspiratory widening

[2] The method described is the one employed by me at Hillcroft Sanatorium, Lunenburg, Mass. Such complete rest was rarely possible among patients in the tuberculosis class. When free from fever they have usually bathed themselves, gone to the lavatory several times a day, taken their meals at the table, and attended the class meeting every week or two. During the past two years patients were not allowed to attend a meeting oftener than once or twice a month.

of the thorax, especially of the lower ribs (Kaiser (28)). The patient should lie chiefly on the side of the chest that is most diseased. The placing of a small, firm pillow under the dependent side, as advocated by Webb (29), will aid in keeping the lung at rest.

There should be mental as well as physical rest. The fewer the visitors the better. All excitement should be avoided, and talking restricted. The amount of reading should be limited, and little writing allowed. Games and knitting are forbidden, except as recognized forms of exercise after the initial period of strict bed rest. Coughing is injurious, but rest has proved so effective in favorable cases that I have made little use of drugs. I am inclined to think that I should have used them more freely in controlling the cough during the first weeks of treatment.

The duration of this period depends more on the severity and extent of the disease in the lungs at the time treatment is begun than on the extent or rapidity of the improvement during the first weeks of treatment. Caution may delay unnecessarily the time when exercise may be started in safety, but no harm will be done. "Long do the live coals glow unnoticed and unsuspected beneath the dead ashes" (Penzoldt).

IMMOBILIZATION IN CASES WITH FEVER

Patients with fever should have the same form of rest treatment in bed as is given in typhoid fever or pneumonia. I have seen a fever that has persisted for months in spite of bed rest cease within a few weeks after the patient was forbidden to feed herself or make any motion of her hands, except to handle the sputum box. Typhoid rest in tuberculosis was advocated by Penzoldt (16) as long ago as 1903. Paterson of Frimley found that typhoid rest brought the temperature more quickly to normal than ordinary bed rest in tuberculosis.

Exercise in any form should not be permitted, no matter how long bed rest has been continued, until at least several weeks after the temperature has reached normal—and that is 98.6 (mouth) and 99.4 (rectal) in women as well as men. In order not to overlook any febrile movement the temperature should be taken every two hours from 8 a.m. to 8 p.m. for a few days. Walking to the lavatory is the first exercise allowed. Later patients are permitted to sit up at a table for a single meal.

When exercise of any form is begun it is well to follow Lawrason

Brown's rule and take the allotted amount every other day. Injury from overexertion may thus more readily be detected. After the long period of bed rest that I employ, exercise can usually be quite rapidly increased without danger of auto-inoculation or lighting up of the infection. Walks are first limited to five minutes on the level. Usually the amount is increased five minutes a week. The rectal temperature is taken on the return from the walk, and again after fifteen minutes' rest. It should fall to 99.4 or below within this time. Rarely do I increase the duration of the walk beyond one hour before the patient is sent back to work.

It should be clearly understood that it is rest and not exercise that promotes healing of the lung. Hence, when exercise is employed it is not as a means of cure, but to make the required period of rest treatment less dull, to encourage the patient, and to prepare him for a return to a normal life.

OBJECTIONS TO THE REST TREATMENT

1. It is sometimes stated that the rest treatment was formerly carried to an extreme and harm resulted. This assertion is never supported by any facts. Recently I was told that the place where the rest treatment was formerly overdone was Saranac Lake. Investigation reveals that there is more insistence on the rest treatment at Saranac now than in the past. For ten years I have used a more prolonged rest treatment than is recommended by any other writer. The result was not injury to the patients but a larger percentage of recoveries.

2. One objection often advanced meets ready acceptance. It is a plea for modifying the treatment according to the condition of the individual patient. One should have rest, we are told; another, exercise. The answer to this is that the part affected with the tuberculous disease should be given as much rest as possible in order to effect its healing. We could with as much reason speak of giving one patient rest and another exercise in typhoid fever or pneumonia as in active pulmonary tuberculosis.

3. Prolonged rest, we are told, may weaken the heart. This is a theoretical objection. In none of my patients have symptoms of cardiac weakness developed.

4. The patients, so advocates of exercise assert, are made lazy and unwilling to work. Enforced rest in my experience has never converted an industrious person into a lazy loafer. All my patients with

arrested disease from among the wage-earners have gone back to work, and the earnings of the poor consumptives after taking the rest treatment in my class amount to about $300,000.

5. The rest treatment is said to make the patients nervous and depressed. This does not occur in my experience if the patient has the right mental attitude. I have never had to abandon the bed-rest treatment because the mental effect was injurious. I never cease to wonder at the cheerfulness and fortitude that the great majority of the patients display. Some one has said that the physician who begins the treatment fearful in his own mind of the injurious psychic effect of prolonged rest on his patient is foredoomed to failure.

COMPARISON OF RESULTS OBTAINED BY GRADUATED EXERCISE AND BY BED REST

For this purpose the results obtained at the Brompton Hospital Sanatorium (21) at Frimley with graduated exercise have been selected to compare with our cases treated with prolonged bed rest. It should be remembered that the cases for Brompton were chosen with care, and that during the early years the work of the individual patients was supervised by Paterson. The personality of the physician in charge of tuberculous patients is of great importance and certainly the Frimley experiment was aided by the personality of its medical director. If the treatment by graduated exercise were the proper one the Frimley experiment would have been a success.

The results that I report at this time have been obtained in the homes of the sick poor in a supposedly unfavorable climate. Supervision was maintained by the class method (30). There has been no selection of cases. In 36 per cent the disease was far advanced when the rest treatment was begun. The average duration of bed rest treatment has been about four months, and the duration of graduated exercise combined with bed rest four to seven months, making the usual duration of treatment from eight to eleven months. A few patients have not been allowed to take regular exercise for from one to two years. Strict obedience to the rules was required but I have included in the tabulated results (table 1) those who were dismissed because they did not follow the rest treatment faithfully, those who left the class voluntarily, as well as those who died while taking the treatment Eighty-eight per cent of those admitted in the first stage were well and working one to

ten years after their discharge, 62 per cent of the second stage cases, and 20 per cent of the third.

In the period of ten years ending July, 1915, there had been treated 191 patients. The condition of those patients one to ten years after their discharge is given in table 1.

The cases selected for the comparison of the effect of prolonged rest with graduated work are those in which the wage-earning power had been restored while under treatment (table 2, chart 1). Many if not most of the Brompton patients had done five hours of hard labor a day before leaving the sanatorium without any apparent ill effect. After returning to work a great number of these broke down within the first two years. The rapid drop in the percentage of patients well and

TABLE 1

*Emmanuel Church Tuberculosis Class: stage of disease and condition of all cases one to ten years after discharge, including those who died while under treatment in the class.**

STAGE	TOTAL NUMBER	PER CENT	CONDITION JULY, 1916			
			Well	Living	Dead	Per cent well
I	67	35	59	2	6	88
II	55	29	34	2	19	62
III	69	36	14	9	46	20
Total	191	100	107	13	71	

* Seventy-six per cent of the first and second stage cases were well. No first stage patients died in the class. All the cases were traced.

working is strikingly shown on the chart in the sharp and sudden drop of the line from 100 per cent at the beginning to 62 per cent at the end of one year and 50 per cent in two years. The upper line gives the after-results among my patients who had prolonged bed rest. Here in the first year there is a drop of only 5 per cent.

The chart and table show most clearly that prolonged rest leads to permanent recovery in a large proportion of the cases treated, and that strengthening a man's muscles and improving his general condition by graded work does not heal the tuberculous process in the lungs.

It might be urged that it is not right to compare the small number of cases treated in the Emmanuel Church tuberculosis class with the large number treated in the Brompton Hospital Sanatorium. On examination of table 2 it will be seen that this criticism is not valid. It is

true that at the end of one year after discharge there were 593 well and working in the group of Brompton cases and only 40 among the class patients. So superior is the rest to the exercise treatment in its end-

TABLE 2

*After-condition of patients with tubercle bacilli in sputum, discharged with wage earning power restored**

NUMBER OF YEARS AFTER DISCHARGE	BROMPTON HOSPITAL SANATORIUM; TREATMENT, GRADUATED LABOR				EMMANUEL CHURCH TUBERCULOSIS CLASS; TREATMENT, PROLONGED BED-REST		
	Total number of cases	Number of cases minus those lost sight of	Number working	Per cent working	Total number of cases	Number working	Per cent working
1	1051	965	593	61	42	40	95
2	1051	868	434	50	39	36	92
3	741	581	265	46	39	34	87
4	475	344	153	44	38	29	76
5	292	209	81	39	34	24	71
6	150	96	40	42	32	22	69
7	39	22	5	23	30	21	70
8					20	14	70
9					14	9	64
10					8	4	50

* In the Brompton table those lost sight of have been deducted in determining the percentage working. There were none lost sight of in the Emmanuel Church Tuberculosis Class.

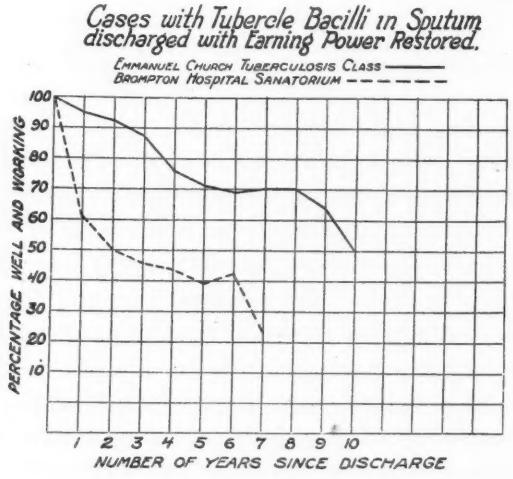


CHART 1

Patients with tubercle bacilli in sputum discharged with earning power restored; solid line, Emmanuel Church tuberculosis class; broken line, Brompton Hospital Sanatorium.

results that the number of class patients well and working at the end of the seventh year was twenty-one while the Brompton figure was reduced to five.

That patients who follow this plan of intensive rest treatment are not prone to relapse is shown in the chart. The sudden drop in the line at the tenth year is due to the fact that two of the patients who returned to work in 1906 with the disease arrested died several years later of acute lobar pneumonia. There were no symptoms of tuberculosis at the time the fatal illness developed.

It is generally conceded that the home treatment of pulmonary tuberculosis is rarely successful when the usual hygienic-dietetic methods are employed. Supervision in a sanatorium or hospital can be carried out more readily and satisfactorily than in the patient's home, and yet our statistics show that prolonged rest in bed at home has yielded better results than have been obtained in sanatoriums where the modified rest or graduated exercise treatments have been employed.

The patients at Rutland Sanatorium (31) in Massachusetts from Boston and its suburbs lived under the same social and economic condition. Rutland, although limited to favorable cases, had less than 25 per cent of its patients well and working eight to ten years after their discharge, while 59 per cent of our patients were well and working after this length of time.

Among a large series of patients from Boston and vicinity who were treated at the Massachusetts state sanatoria, Miss Farmer (32) found that 24 per cent were well four to seven years after their discharge; while 63 per cent of our class patients were well four to seven years after their discharge.

The study of statistical reports shows that the more rest employed the larger the percentage of recoveries. Dettweiler by the use of prolonged rest in reclining chairs combined with exercise obtained a larger percentage of recoveries than any one had previously reported. Among 1022 patients the disease was arrested in 242, or 24 per cent. Turban using more rest achieved still better results: 80.4 per cent of the first stage cases, 48.8 per cent of the second, and 17 per cent of the third were well one to seven years after their discharge from the Sanatorium. Long continued rest in bed as our figures show gives the best results of all.

CONCLUSIONS

This investigation shows that the failure to cure pulmonary tuberculosis is not due to the incurability of the disease but to the fact that the proper treatment has not been employed. Tuberculosis can be cured in and out of sanatoria in a larger proportion of cases by the strict rest treatment.

As the most complete rest can only be obtained in bed, it is evident that bed rest out of doors should yield a larger percentage of recoveries in a shorter period of time than any other known method. The results published in this report confirm these statements.

REFERENCES

(1) HAMMAN, L.: Introduction to the tuberculosis nurse. E. N. LaMotte, New York 1915, 6.
(2) HOCHHAUSER, E.: Before and after-care of the tuberculous. J. Outdoor Life, 1914, xi, 240.
(3) HAWES, J. B. 2d: What Massachusetts is doing. Am. Rev. Tub., 1917, i, 163.
(4) Tenth Annual Report of the Trustees of Massachusetts Hospitals for Consumptives. Boston, 1917.
(5) BROWNE, T.: Letter to a friend, in Religio Medici and other papers. Boston, 1889, 10.
(6) WATSON, T.: Lectures on the principles and practice of physic. Third Amer. Edition, Philadelphia, 1854, 652.
(7) BREHMER, H.: Die Therapie der chronischen Lungenschwindsucht. Wiesbaden, 1887.
(8) DETTWEILER, P.: Die Behandlung der Lungenschwindsucht. Berlin, 1880.
(9) DETTWEILER, P.: Die Therapie der Phthisis. Verhand. d. Kong. f. in. Med., Wiesbaden, 1887, vi, 13.
(10) KRETZSCHMAR, P. H.: Dr. Dettweiler's method of treating pulmonary consumption. N. Y. M. J., 1888, xlvii, 175.
(11) DETTWEILER, P.: Bericht über zwei und siebzigen seit drei bis neun Jahren geheilte Fälle von Lungenschwindsucht. Frankfurt am Main, 1886.
(12) TRUDEAU, E. L.: An autobiography. New York, 1916, 154.
(13) TURBAN: Beiträge zur Kenntniss der Lungentuberkulose. Wiesbaden, 1899.
(14) CORNET, G.: Die Tuberkulose. Wien, 1900.
(15) PENZOLDT, F.: Handbuch der Therapie (Penzoldt und Stintzing). Dritte Auflage. Jena, 1902, iii, 390.
(16) PENZOLDT, F.: Ueber das Maas der Bewegung bei der Behandlung der Lungentuberkulose. München. med. Wchnschr., 1903, l, 10.
(17) DUMAREST, M. F.: La cure de travail chez les tuberculeux. Bull. Med., 1909, xxiii, 1061.
(18) MINOR, C. L.: On the feasibility and management of a hygienic cure of pulmonary tuberculosis outside of closed sanatoria. N. Y. M. J., 1901, lxxiv, 1137, and 1902, lxxv, 49.
(19) FLINT, A.: Treatise on the principles and practice of medicine. Sixth edition, Philadelphia, 1886, 206.
(20) PATERSON, M. S.: Graduated labor in pulmonary tuberculosis. Tr. Sixth Internat. Cong. Tuberculosis, 1908, i, 866.
Auto-inoculation in pulmonary tuberculosis. London, 1911.

(21) Report on the After-Histories of Patients Discharged from the Brompton Hospital Sanatorium, at Frimley, in Surrey, during the years 1905–1910. Aldershot, 1914.

(22) BARNES, H. L.: The value of auto-inoculation in pulmonary tuberculosis. Trans. Nat. Asso. Study and Prev. Tub., 1913, ix, 246.

(23) BROWN, L.: Recent advances in the treatment of pulmonary tuberculosis by air, food and rest. J. A. M. A., 1912, 1678.

(24) TENDELOO, N.: Die Bedeutung der Atmungsgrosse für die Entstehung und die Ausdehnung bezw. Ausheilung der Lungentuberkulose. Beitr. z. Klin. d Tuberk., 1908, xi, 229.

(25) RUBEL, A.: Zur Kenntniss der Wirkung funktioneller Ruhe der Lunge auf die Ausbreitung und Verlauf der Lungentuberkulose. Beitr. z. Klin. d. Tuberk., 1911, xviii, 145.

(26) KRAUSE, A. K.: The nature of resistance to tuberculosis. Johns Hopkins Hosp. Bull., 1917, xxviii, 191.

(27) BROWN, L.: Rules for recovery from pulmonary tuberculosis. Philadelphia, 1915.

(28) KAISER, quoted by Schroeder, G.: Allgemeine Therapie, in Brauer, L., Schroeder, G., and Blumenfeld, F.: Handbuch der Tuberkulose. Leipzig, 1914, ii, 15.

(29) WEBB, G. B.: Rest of the individual lung by posture. Tr. Nat. Asso. Study and Prev. Tub., 1916, xii, 182.

(30) PRATT, J. H.: The class method of treating consumption in the homes of the poor. J. A. M. A., 1907, 755.

PRATT, J. H.: Results obtained in the treatment of pulmonary tuberculosis by the class method. British M. J., 1908, ii, 1070.

PRATT, J. H.: The class method in the home treatment of tuberculosis and what it has accomplished. Boston M. and S. J., 1912, clxvi, 280.

PRATT, J. H.: Results obtained by the class method of home treatment. Twelfth An. Meeting Nat. Asso. Study and Prev. Tuberculosis, Tr., 1916, xii, 128.

PRATT, J. H.: The tuberculosis class, an experiment in home treatment. J. Outdoor Life, 1917, xiv, 74.

(31) Fourteenth Annual Report of the Trustees of the Massachusetts State Sanatorium at Rutland. Boston, 1911.

(32) FARMER, G. L.: Is sanatorium treatment worth while? Boston M. and S. J., 1914, clxx, 411.

A COMPARISON BETWEEN THE SKIN TESTS, USING VARIOUS TUBERCULOSIS ANTIGENS, AND THE COMPLEMENT FIXATION PHENOMENON

F. W. WITTICH

From the Tuberculosis Department of the University of Minnesota

Much interest has been aroused recently in the complement fixation test in tuberculosis. The observations as initiated by Bordet and Gengou (1) in 1903, and early investigators such as Wassermann and Bruck (2) and Citron (3) were far from uniform because of technical difficulties. Aside from sporadic observations the subject did not promise particular results until improved methods were introduced during the past few years. The proposal of various antigens and modifications followed so quickly the nearly specific results of Besredka (4) and the users of his antigens or modifications, particularly those of the French observers as well as of Craig (5) and Bronfenbrenner (6), that the literature on the subject has become very extensive. Antigens of bacillary suspensions, filtrates or tuberculins, and various extracts as well as different tissue extracts have been used. More recently the observations of Miller (7) and those of Petroff (8) would indicate that the complement fixation test in tuberculosis is approaching the much desired specificity.

The clinician always welcomes any laboratory methods that will help him make a diagnosis. Especially is this true in tuberculosis where the line between the infected and the diseased at times requires the utmost diagnostic skill. Anyone in a tuberculosis dispensary who examines a large number of cases referred to him from the various departments of medicine and surgery for diagnosis because of one or more symptoms of chronic or acute infection, will be glad to make use of any serological tests that will help him reach final definite conclusions. The tuberculosis clinic of a university medical school, as a clearing station for sanatoria and "court of appeal" for many borderline medical cases, can very advantageously make use of such tests if reliable; for upon a diagnosis may depend the advisability of a goitre operation where tachycardia and the nervous manifestations may be of tuberculotoxic origin and the goitre a benign affair, or of a therapeutic abortion that may be done unnecessarily.

The subcutaneous tuberculin test should be limited to those patients who can be observed carefully under control in a hospital or a sanatorium after the injection. Too often the test is like cutting into the hone with the razor to see if the blade is sharp; we make our diagnosis but do harm to the patient. The advocates of large doses of tuberculin subcutaneously are many times placing a two-edged sword in the hands of the unskilled.

The use of the various skin tests has shown that there is apparently no relation between the reaction and the amount of disease or infection other than that it denotes the invasion of the tissues by the tubercle bacillus at some time or other.

As a result of the introduction of modern methods of the fixation test and the different antigens it was thought that observations on a series of cases using the various antigens intracutaneously as well as in the haemolytic tests might lead to some conclusions as to their specificity: wherein they differ or correlate; or if the recently proposed antigens would be of more value than the older tuberculins and methods used intracutaneously. This small series of observations is given with the hope that it may be of value, however insignificant, along this line of work.

For the complement fixation tests I am entirely indebted to Dr. Elizabeth A. Woodworth, bacteriologist for the City Health Department, Minneapolis, which city has a free Wassermann service. Without her valuable assistance the work could not have been done. Her work was carried on entirely independently of the skin tests and clinical observations so that the results could not be biased.

The majority of patients used were from the University Tuberculosis Dispensary but I am grateful to Dr. Walter Marcley for making available the clinical data and use of patients at Glen Lake Sanatorium, and for his assistance in reading the results of the skin tests of those patients.

ANTIGENS

The antigens selected were those which have shown the most promising results as well as those representing different groups:

Koch's old tuberculin or glycerin bouillon filtrate; 0.05 cc. of a 1/10000 dilution was used.

Craig's:[1] Besredka tuberculin or filtrate, a modified alcoholic ex-

[1] Furnished by Parke, Davis and Company, Detroit.

traction. Besredka's tuberculin is a filtrate of growth in egg-meat-broth medium. Craig's modification consists in an extraction of its lipins to avoid non-specific cross fixation with luetic sera.

Miller and Zinsser:[1] A bacillary suspension, 1 unit = 0.05 mgm. "Prepared by triturating living or dead bacilli with dry crystals of ordinary table salt, then adding distilled water up to isotonicity." The bacilli were killed by heat in the antigen used for these tests.

Petroff's: Furnished by Mr. Petroff. A 1 per cent sodium hydrate extract of five strains of virulent cultures pulverized and neutralized with normal hydrochloric acid.

Krause's: Furnished by Dr. Allen K. Krause. A watery extract of culture H37, a human tubercle bacillus which produces generalized tuberculosis in guinea pigs. This antigen was used as representing a pure tuberculo-protein in testing hypersensitiveness and had been used hitherto by Dr. Krause only on guinea pigs. A 1/1000 dilution was used in the tests.

COMPLEMENT FIXATION

The technic of the complement fixation tests carried throughout by Dr. Woodworth was as follows:

Patients' sera: The patients' sera were inactivated in a water bath for one-half hour at 56°C.

Antigen: The quantity of some of the antigens being limited the amount used in the tests was as near to 0.1 cc. as the titration would permit.

Haemolytic system: The haemolytic system was antisheep, and the amboceptor was of high titre, 1:3000.

Sheep's red cells: A fresh 5 per cent suspension in 0.85 per cent sodium chloride solution.

Complement: Ten per cent of fresh guinea pig serum was used in all the tests. The complement was carefully titrated and a single unit of complement and one and one-half units of amboceptor were used in the tests.

The test was made by adding 0.1 cc. of inactivated serum, one unit of antigen, one unit of 10 per cent complement and sufficient 0.85 per cent sodium chloride solution to make up a total volume of 1 cc. This was shaken well and incubated at 38°C. for one-half hour, when it was removed, shaken and one and one-half units of amboceptor and 0.1 cc. of sheep's red cells were added. After shaking, incubation was

again done one and one-half hours, when readings were taken. The tubes were allowed to stand and another reading was made later to check the first readings. Anticomplementary tests were carried out as well as the careful titration of amboceptor in each series.

A routine Wassermann test was done with all of the sera but observations would be irrelevant to the subject under discussion. It may be briefly stated, however, that the percentage of Wassermanns was comparatively high among the clinically active cases.

THE INTRACUTANEOUS TESTS

The technic of using the antigens intracutaneously was as follows. The upper arm was washed with ether and the various antigens introduced by means of an all-glass Luer syringe graduated in hundredths. The needles were the smallest size obtainable. The bevel of the needle faced outward and the needle was inserted far enough between the skin layers so that leakage did not occur from the point of puncture. Uniform dosage of 0.05 cc. was used after the first series of 0.1 cc. which was found to produce too marked a reaction. At the same time blood was obtained from the median basilic vein aseptically by means of a syringe. The blood specimens were placed at room temperature for one hour and then in the ice box for separation before inactivation which was done early. Observations of the arms were first made at the end of twenty-four hours but later at the end of forty-eight hours as the maximum intensity usually was reached at the end of the second day. There were too few reactions earlier than this to bear any significance. The reaction usually lasted in greater or less intensity for five days when there was a rapid subsidence.

The skin reactions produced by the various antigens were fairly characteristic. The majority reached a maximum intensity from twenty-four to forty-eight hours. Craig's antigen usually produced a central pin-head pustule surrounded by a slightly elevated deeply reddened area from 0.5 to 1 cm. in diameter and this area was surrounded by a wider zone of hyperaemia of less intensity. Miller's antigen very seldom produced pustulation. The characteristic reaction was a deeply colored papule from 0.5 to 1 cm. in diameter with very slight or no surrounding hyperaemic zone. Petroff's antigen usually produced the most marked reaction characterized by a larger but more diffuse slightly elevated yellowish central zone surrounded by a deep colored infiltrated

area of comparatively small extent but shading off into a diffuse blush which extended anywhere from 1 to 5 cm. in width. Koch's O. T. and Krause's antigen were similar in producing a smaller papule with little or no surrounding hyperaemic zone.

When the four tests were done on the same arm the marked reactions sometimes would be attended with pain and tenderness. Itching was a common manifestation. The axillary glands were tender and palpable in some of the cases and a general reaction could not be ruled out in three cases. The one case particularly was an advanced, unfavorable bed patient. The local reactions came on sooner than usual and were of unusual severity when they subsided early. Some of the reactions became more severe after the observations were made but this was attributed to the scratching done by the patients which it was hard for them to control.

It was difficult to classify the reactions but erythema was considered +, a small papule ++, a small papule with pustule and erythema +++ and a larger one ++++. The reaction was called negative when nothing was visible except the point of needle insertion.

For each patient the same antigens were used for the skin and fixation tests. However, in a number of instances fixation tests were done with additional antigens which results were considered and included when making Chart 1. A number of skin and fixation tests was done that had to be ruled out for final conclusions because of not furnishing data to make comparisons. X-ray and fluoroscopy examinations were made to confirm the physical diagnosis of about 80 per cent of the patients in this series and the sputum of practically all the cases was examined.

RESULTS

The comparative results of the tests may be summarized in the following table and chart.

TABLE 1

	NUMBER CASES	INTRACUTANEOUS	ANTIGEN	FIXATION
		per cent positive		*per cent positive*
Stage I	11	27.3	Koch's O. T.	54.5
	13	92.3	Miller's	69.2
	13	92.3	Craig's	92.3
	5	100.0	Petroff's	60.0
			Krause's	
Stage II	11	72.7	Koch's O. T.	81.8
	11	100.0	Miller's	63.6
	11	100.0	Craig's	81.8
	17	100.0	Petroff's	70.6
	7	71.4	Krause's	85.7
Stage III	14	78.6	Koch's O. T.	64.3
	11	100.0	Miller's	54.5
	13	84.6	Craig's	84.6
	12	100.0	Petroff's	91.7
	4	100.0	Krause's	75.0
Latent or quiescent	4	100.0	Koch's O. T.	100.0
	5	100.0	Miller's	20.0
	5	100.0	Craig's	60.0
	3	100.0	Petroff's	00.0
	1	100.0	Krause's	00.0
Doubtful	7	28.6	Koch's O. T.	85.7
	9	66.7	Miller's	22.2
	9	66.7	Craig's	66.7
	4	75.0	Petroff's	50.0
			Krause's	
Negative[1]	11	18.2	Koch's O. T.	54.5
	23	60.9	Miller's	17.4
	24	54.2	Craig's	50.0
	15	66.7	Petroff's	20.0
	3	66.7	Krause's	33.3
Totals, clinically active cases..	36	61.1	Koch's O. T.	66.7
	35	97.1	Miller's	62.9
	37	91.9	Craig's	86.4
	34	100.0	Petroff's	76.5
	11	81.8	Krause's	81.8

[1] Negative includes cases of bronchial asthma, chronic bronchitis with emphysema, and bronchiectasis, as well as five people with apparently normal health.

CHART 1

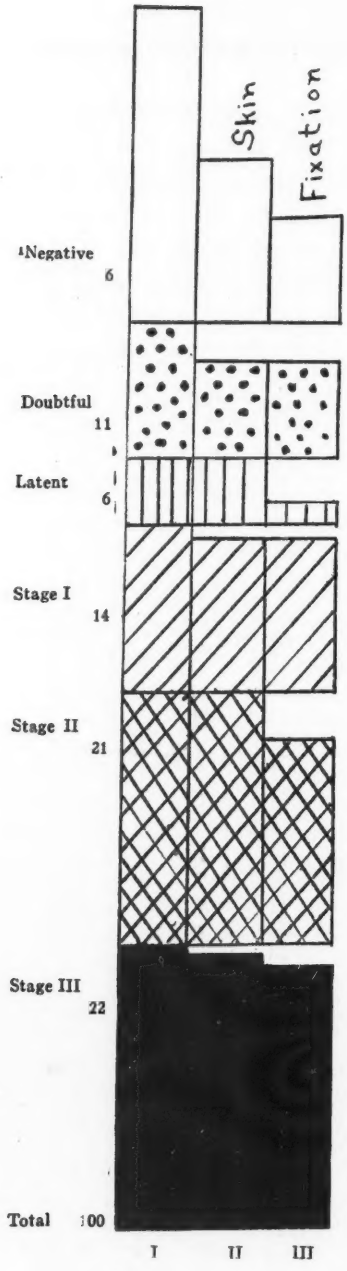


CHART I

Column I represents the total number of cases upon whom intracutaneous and fixation tests were made with two or more antigens.

Column II represents the total number of cases that reacted positively to the skin tests with two or more antigens.

Column III represents the total number of cases whose fixation was positive with two or more antigens. (+, considered negative: ++, +++, ++++ positive.)

[1] Two cases of bronchial asthma who were negative to the fixation tests responded very strongly to all the antigens intracutaneously. Both were taking potassium iodide.

DISCUSSION AND CONCLUSION

For diagnostic purposes the antigen of greatest value would be that which showed the highest percentage of positive results among the clinically active cases of the first stage as well as the highest percentage of negative results among the clinically negative cases. In our series of fixation tests Miller's showed this. Petroff's percentage of negative results among the negative cases was practically as high. Craig's showed a higher percentage of positive results with the clinically active patients but the number of negative cases showing positive fixation results was much higher than with the other antigens. This antigen appeared the most sensitive for the complement fixation tests.

The intracutaneous tests made with Craig's antigen gave a high number of positive reactions among the clinically active cases and the highest (Koch's O. T. excepted) number of negative results among the clinically negative cases. The results with Miller's antigen closely approximated those with Craig's. The high percentage of negative results among the clinically negative and the latent or quiescent cases with Koch's O. T. would make it the most valuable as a negative intracutaneous test according to this series.

The latent or quiescent cases in which the fixation test was done with Petroff's antigen were negative. It is also interesting to note that with Petroff's antigen all of the clinically active cases showed positive skin reactions and an increasing percentage of positive results with the fixation tests as the disease progressed. However, the comparatively low percentage of positive fixation results with both Miller's and Petroff's antigens in cases of stages I and II of the disease may be explained by the fact that the fixation test of about one-half of those patients who were showing marked improvement and approaching quiescence was negative. The fixation tests with both these antigens in approximately the same proportion (one-half) for the cases in stage III whose disease was progressing rapidly showed negative or weakly positive. With Petroff's antigen the active cases showed a high percentage of positive results and the arrested ones a high percentage of negative with the intracutaneous test.

From these observations it would seem that if intracutaneous tests were done using Miller's, Craig's and Koch's O. T. antigens as well as fixation tests with Miller's and Craig's antigens, the results would be valuable in confirming physical findings. By doing repeated fixation

tests with Petroff's antigen during the course of the disease, valuable prognostic data could be obtained.

Too few cases were run through with Krause's antigen to allow any general conclusions of value to be drawn but it stood up well on those that were done.

Through the courtesy of Dr. Larson, Professor of Bacteriology of the University of Minnesota, several fixation tests were made with his antigen. No skin tests were done with this antigen so that a comparison cannot be made. However, the fixation results corresponded with the physical findings of the patients, most of the clinically active cases showing a positive and the negative cases showing a negative fixation.

The skin tests can be done by the clinician and the fixation work easily carried on with the Wassermann tests.

The number of cases in our series is too small especially that of the latent or quiescent group to allow general conclusions of great value to be drawn. We are doubtful of the specific value when either the skin or haemolytic tests are done alone as far as differentiating between infection and disease. We do believe that done together they are of greater value than when either is done separately and together they furnish valuable confirmatory data to the other findings. Whether there is any relationship between the skin and fixation tests in certain stages of the disease and with certain antigens we are not prepared to say but it would seem that not all our results could be mere coincidence. No attempt whatever is made to interpret the results in the light of more recent observations on the mechanism of cutaneous hypersentiveness and the presence of antibodies in the blood. We feel that the tests were carried out as carefully as the average, and present our results hoping that they may be of value at least in stimulating the practical application of the more recent serological studies.

REFERENCES

(1) Bordet and Gengou: Compt. rend. Soc. de Biol., 1913, lxxiv, 225.
(2) Wassermann and Bruck: Deutsche med. Wchnschr., 1906, xxxii, 449.
(3) Citron, J.: Berl. klin. Wchnschr., 1907, lxvi, 1135.
(4) Besredka, A.: Ztschr. f. Immunitätsforsch. u. exper. Therap., Jena, 1914, xxi, 77.
(5) Craig, Charles: Am. J. M. Sc., 1915, cl, 781.
(6) Bronfenbrenner, J.: Arch. Int. Med., 1914, xiii, 786.
Bronfenbrenner, J.: Ztschr. f. Immunitätsforch. u. exper. Therap., 1914, xxiii, 221.
(7) Miller and Zinsser: Proc. Soc. Exper. Biol. and Med., 1916, xxiii, 134.
(8) Petroff, S. A.: Am. Rev. Tub., 1917, i, 33.

ARE SANATORIA WORTH WHILE

BERNICE W. BILLINGS AND JOHN B. HAWES, 2ND

The state of Massachusetts spent over $1,000,000 last year in the construction and maintenance of its hospitals and sanatoria for consumptives. The total amount spent for tuberculosis, including that for local tuberculosis hospitals, dispensaries, and institutions for non-pulmonary tuberculosis exceeded $3,000,000. There are over 3000 beds for consumptives in the state, and more than 1000 beds in the four sanatoria maintained by the state. Last year there were approximately 3000 patients cared for in these four state sanatoria. The object of this study that we have made was to ascertain, if possible, from an impartial point of view, whether this large sum of money invested by the state is or is not a profitable investment; first, from the point of view of dollars and cents, second, from the point of view of individual health and happiness, and third, from the point of view of preventive medicine. This paper is based upon an examination of the present condition of 1056 patients discharged from our state sanatoria at North Reading, Lakeville, Westfield and Rutland during the two years from May 1, 1912 to May 1, 1914.

These patients were not of the selected incipient class, or even moderately advanced cases. All stages are included, nearly 50 per cent being classified on admission to the sanatorium as far advanced. Of the 1056 patients, 17 per cent were incipient, 36 per cent moderately advanced, and over 46 per cent far advanced. It is important to bear in mind in studying the results we have obtained, therefore, that the proportion of moderately advanced and advanced cases in this group under consideration was more than 82 per cent of the whole. Each of these patients was visited by Miss Billings within three months after discharge from the sanatorium. In the early days of her work of looking up and instructing these patients, Miss Billings did all of this visiting herself. Gradually she has been able to develop local resources to such an extent that in December, 1916, when we looked up the present condition of these patients, about 50 per cent of our reports were based on information from nurses in the employ of local boards of health and others whom Miss Billings had instructed in this work.

In describing the condition of these patients, we have used the terms "good condition," "living," "died," "left the state or unknown." The two latter terms need no explanation. The term "good condition" is based on Miss Billings's own judgment at the time of her visit as to whether or not the patient was apparently well and strong, and up and around, although not necessarily at work. Those classified as "living" are those who do not belong to one of the other three classes, and who, though still living, are in most cases manifestly sick.

Of these 1056 patients, when Miss Billings first visited them, which as mentioned above was in each case within three months after leaving the sanatorium, 28 per cent were in good condition, 50 per cent were alive though not in good health, over 11 per cent had died, and 9 per cent had disappeared. Thus out of the original 1056 patients, only 845 were available as far as Miss Billings's efforts in her after-care work were concerned. We have included in our calculations of the present condition of these patients not only the 845 with whom Miss Billings actually came in contact, but also the 211 others who had either died or disappeared before her first visit.

The present condition of the 845 remaining patients, as based on visits by Miss Billings and detailed reports from other reliable sources in December, 1916, shows, as would be expected, that a large number of those who were classified at their first visit as "living" had died, while a small proportion of the same group now falls into the class designated as "in good condition and working." Twenty-nine per cent were in good condition and at work, as compared with 28 per cent at the first visit; 11 per cent were classified as "living," as compared with 50 per cent at the first visit; and 45 per cent had died, as compared with 11 per cent at first.

As would be expected of a group of patients 46 per cent of whom were in the far advanced stages of consumption when they were first under treatment, which in every case was from three to five years ago, a large number have died. Of the original 1056 patients, 46 per cent of whom were in the advanced stages, 45 per cent are now dead. On the other hand, although less than 17 per cent were classified as "incipient" on admission, 312 or 29 per cent are now in good condition and at work. Of these 312 patients who are now in good condition and regularly at work, 35 per cent were incipient on admission, 45 per cent were classified as "moderately advanced," and 22 per cent as "advanced." These figures appear to us in many ways remarkable,

and we frankly are at a loss to offer an adequate explanation for them. It is very hard for us to understand, for instance, why there should be a larger proportion of moderately advanced cases over those who were incipient on admission who are now alive and working, as the figures 35 per cent incipient and 43 per cent moderately advanced would show; while again, that 22 per cent of those who are now at work and apparently well were classified as advanced on admission is even more surprising. Nevertheless, we feel that the figures we are giving here are based on excellent evidence and that they cannot well be disputed. Our own explanation of this is, first, that many of the incipient have very little or no resistance and are bound to go steadily down hill, regardless of treatment, and second, of still more importance, that the patient with incipient tuberculosis does not seem to be sufficiently impressed with the seriousness of his condition, so that after being discharged as "arrested" or "quiescent" he sees little or no reason for continuing the rules and regulations that he was made to follow while in the institution, which, in his case, he regards as quite unnecessary. The moderately advanced case, however, is made to feel differently in regard to this. He has had a long and weary fight for his health, and for a time, at least, has apparently won out. Our figures would seem to indicate that the average patient in this class is more seriously impressed with the need of further treatment and of living a carefully regulated life. Despite this explanation, it still seems hard to understand why the patient with moderately advanced tuberculosis should appear to have a better chance of becoming a useful citizen than the patient with incipient disease.

As to the far advanced cases, comprising 22 per cent of those who are now alive and working, it is to us further proof that the pessimist has no place in the field of tuberculosis and that when the question is asked, "Have I a chance, doctor?," the answer should always be in the affirmative. One important reason for this is doubtless that a large proportion of these patients with advanced disease now alive and at work are cases of chronic fibroid phthisis, with well established resistance, so that the acute flare-up which led to their going to a sanatorium was but an incident of short duration which in no way prevented their leading a long and useful life. Likewise, it shows a fault in our present classification, in that the word "advanced" often gives a wrong impression of the patient's condition, and is based rather on the extent of the disease in the lungs than on to what extent the disease is progressive or disabling to the patient. Furthermore, if the figures were available it would doubt-

less be found that the average age of this group of advanced cases was far greater than that of the patients with incipient or moderately advanced tuberculosis.

In considering these 312 patients now in good condition and working, we would naturally expect that no matter what their condition on admission—incipient, moderately advanced, or advanced—it would surely be from those classified on discharge as "arrested" or "quiescent," rather than from those discharged as "improved" that good results were to be obtained. Such was not entirely the case, however. Although 58 per cent of these 312 patients were discharged as "arrested" or "quiescent," 30 per cent were discharged as merely "improved." Again among those classified as "advanced" on admission we surely thought that the best results would be obtained from those discharged as "arrested" or "quiescent." It was surprising to us to find that of the 71 advanced cases in this group only 40 per cent were discharged as "arrested" or "quiescent," while 47 per cent were discharged as merely "improved." We explain this on the grounds that no conservative physician, especially a sanatorium physician, is willing to call an advanced consumptive an "arrested" or "quiescent" case except in very exceptional instances. With the majority he prefers to use the safer term "improved."

The average length of stay of these patients was slightly over six months. In order to confirm our views as to the desirability of a fairly long stay at a sanatorium to produce the best results, we have divided these patients into two classes, those that remained less than six months and those that remained over six months at the sanatoria. As would be expected, our figures show clearly the beneficial results of the longer length of stay.

So far, we have considered results only in terms of health and thus indirectly in happiness. In our own minds, at least, there is no doubt but that our sanatoria and our sanatorium system, incomplete and imperfect as it is, is distinctly worth while from the point of view of health and happiness. That 312 out of 1056 patients, 82 per cent of whom were advanced or moderately advanced consumptives on admission four or five years ago, are now not only alive but actively at work, seems to us encouraging. We now wish to take up this question very briefly from the financial viewpoint.

Although the state charges only four dollars a week for board, which in a very small number of cases is paid by the patient himself, the actual

cost is approximately $9.50 per week. Thus these 1056 patients cost the State of Massachusetts about $9500 weekly. Whether this was paid from private sources, local boards of health or by the state itself is immaterial. We have made a careful inquiry into the earning capacity of the 312 patients who are now alive and at work, and find that these 312 patients are now earning each week approximately $3000. This figure does not include the potential earnings of certain men and many women who were able to work but were not doing so. While of course neither Miss Billings nor I would for a minute claim that this amount of weekly earnings can offset the cost to the state of these 1000 consumptives here under consideration, we do maintain that the money that Massachusetts is spending every year to prevent and control consumption is not entirely lost, and that our sanatoria are distinctly worth while from the financial and economic point of view as well as in every other way. A brief summary of our investigation shows the following facts:

1. Of 1056 patients discharged from Masschusetts state sanatoria from May, 1912, to May, 1914, on admission 17 per cent were incipient, 36 per cent moderately advanced, and 46 per cent far advanced.

2. On the first visit to these patients in their homes, in each case within three months after discharge from a sanatorium, 28 per cent were in good condition, 50 per cent living, 11 per cent dead, and 9 per cent had left the state or disappeared.

3. At present, meaning by this December, 1916, we find that 29 per cent are in good condition and at work, 11 per cent living, 45 per cent dead and 13 per cent have disappeared.

4. Of the 312 patients now in good condition and at work, on their admission to a sanatorium 35 per cent were incipient, 43 per cent moderately advanced, and 22 per cent far advanced.

5. On discharge, these 312 patients were classified as 58 per cent quiescent or arrested, and 30 per cent as improved.

6. Comparing those patients who stayed at a sanatorium under six months with those who stayed longer than this, we find, as would be expected, that distinctly better results were obtained among those patient's whose period of stay at the sanatoria was the longer.

7. The weekly cost to the state of these 1056 patients was approximately $9500. The 312 patients now alive and at work are earning each week approximately $3000. The potential earning capacity of certain patients not working, but able to do so, has not been included in this figure.

CONCLUSIONS

Only very general conclusions can be drawn from such a mass of facts and figures presented here. There seem to us, however, to be certain very striking points. We believe that we have shown that sanatoria are distinctly worth while and should be encouraged in every way, but that some system whereby patients can be looked up, visited, and advised after their discharge, is an essential part of sanatorium treatment.

While early diagnosis is of the utmost importance and while we believe, despite our figures, that the earlier the diagnosis the more favorable the outlook, the fact that a patient is moderately advanced or advanced ought not to discourage us, nor does it necessarily mean an unfavorable prognosis. Our figures would certainly indicate this.

We do not believe that the incipient case is sufficiently impressed with the seriousness of his condition. Likewise the patient discharged with his disease "arrested" or "quiescent" does not always realize how temporary this may be or how slim his margin of safety.

We believe that our classification is wrong, and that there should be more general use made of modified classification, whereby the advanced case is more accurately described than at present. Our own figures, for instance, whereby 22 per cent of our 312 patients now in good condition and working were "advanced" cases we believe to be distinctly misleading.

Finally, we again reiterate our belief that sanatoria are worth while from every point of view, and that proper sanatorium treatment in its broadest sense is one of the most important factors in our campaign to control tuberculosis. By "its broadest sense," however, we mean sanatorium treatment that includes early diagnosis, a length of stay over six months, education of the patient and his family, and supervision of the patient after discharge from an institution. This we believe to be real sanatorium treatment.

A TUBERCULOSIS PREVENTORIUM FOR INFANTS

ALFRED F. HESS

New York

In a paper published over two years ago (1) it was pointed out that there is no provision in the antituberculosis campaign for the protection of the baby. It was found that in over one-third of the homes of the children at the Preventorium at Farmingdale, there were infants under two years of age living in close contact with their tuberculous parents. Further inquiry disclosed the astonishing fact that among the numerous and various institutions in the city of New York, maintained for the purpose of caring for unfortunate and needy children, there was none prepared to admit the infants of the tuberculous poor. The hospitals could not accept them because they were not sick; the orphan asylums refused them admission because the parents were living; and the infant asylums, because in many instances they were not destitute. When the attention of the Commissioner of Charities was drawn to the difficulty of providing for these infants who were exposed to the danger of infection, and who numbered forty-two at that time, he replied that there was no agency or institution in the city equipped to care for this particular class of children.

Convinced of the need of protecting these infants, it was decided at once to establish a tuberculosis preventorium for infants, to determine whether an institution of this kind was practicable. For the past two years this adjunct to our main preventorium has been in operation, and it is the experience of this new work which I desire to bring to your attention. We have not been able to carry out this experiment upon a large scale, having but twelve cribs for this purpose at our disposal, but these have been sufficient to enable us to determine the feasibility of the "infantorium," as it is sometimes termed in Farmingdale, and to furnish information of value, we hope, to others who may care to embark upon a similar undertaking.

An objection which has deterred many from attempting to organize an institution of this type, and one which at first gave us some concern, was that mothers will not part with their babies for an extended period of time. This requirement is essential, as it is evident that unless the

infants are separated from their tuberculous environment for at least a year but little will be accomplished. Strangely enough this misgiving proved quite unfounded. In but two or three cases did mothers apply for the admission of their infants and subsequently refuse to send them because they were required to renounce their claim for a year. Where an infant has been admitted to the Preventorium there was no demand for its return before the conclusion of this period. This was probably due to the fact that some mothers were so weak that they did not wish to be burdened with their children, and that others entered sanatoria after they had disposed of their infants, and, lastly, because the largest number were in an advanced stage of tuberculosis and died a few months after the infant was sent to us.

In this country, in the larger cities at least, the nature of tuberculosis is so well understood by the common people, and its mode of propagation through contact constitutes such everyday knowledge, that it requires very little persuasion to convince a tuberculous mother that she is a menace to her infant, and to assure her of the advantages of separation for the baby as well as for herself.

During this period of two years we have admitted thirty-six infants to the Preventorium. The babies varied in age from about one month to a year, a number of them weighing less than seven pounds. In all but one case the mother was tuberculous, and in instances both parents were affected. In only seven cases did the sputum of the mother show no tubercle bacilli. In other words the mothers were the most active foci of infection.

For the first few months we admitted infants already infected with tuberculosis, as shown by the positive tuberculin reaction. We soon found, however, that the prognosis among this class of babies was very bad, and that it was impossible to prevent the rapid development of the tuberculous process. Among the first eight infants admitted three died of tuberculosis within a few months of admission, in spite of the fact that they were given the benefit of fresh air treatment both by day and by night. It was determined, therefore, to alter our policy and to admit only such infants as gave a negative tuberculin reaction. In this way it seemed possible to select a group which, in general, had not yet been infected, and, therefore, was amenable to preventive measures.

We have admitted twenty-eight infants who gave a negative tuberculin reaction. In most instances they have come from private homes

Group I. Infants showing positive Von Pirquet test

NAME OF INFANT	NO. OF MONTHS NURSED	FATHER			MOTHER			DEATH OF PARENT[1]	DISPOSAL OF INFANT	DEATHS OF INFANTS
		Tuberculous	Stage	Sputum	Tuberculous	Stage	Sputum			
J. B.	7				+	III	+	M	Father	
H. B.	1				+	II	+		Infant asylum	
G. F.	6	+	III	+	+	II	−		Mother (Father died before baby was admitted)	
R. R.	10	+	III	+	+	I	−	F	Infant asylum Boarded out	
T. M.					+	III	+		Mother	
F. D.	4				+	III	+	M		Tuberculosis
C. G.	1¼				+	III	+	M		Tuberculous meningitis
J. Z.	¼				+	III	+	M		Tuberculous meningitis

Group II. Infants showing negative Von Pirquet test

M. A.	½				+	III	+	M	Foundling hospital	
U. C.		+	III	+	+	III	+	M	Foundling hospital	
S. C.					+	III	+			Diphtheria
W. D.	1				+	I	−		Mother	
R. E.		+	I	−	+	I	−		Parents	
D. V.					+	III	+	M	Foundling hospital	
M. T.					+	III	+	M	Father	
H. W.	¾				+	II	+	M	Father	
J. M.	¾				+	III	+	M		Marasmus
L. G.	1½	+	II	−	+	II	−		Parents	
M. S.					+	III	+	M	Infant asylum Boarded out	
M. Y.					+	III	+	M	Father	
C. P.	1½				+	II	+			
E. S.	¾				+	II	−			
M. P.					+	III	+			
I. D.	1½				+	II	+			
J. D.					+	III	+	M	Father	
W. G.	1	+	III	+				F	Mother boarded out	
H. B.	7				+	III	+			
P. D.	¾				+	II	−			Marasmus
F. P.	3				+	III	+		Parents	
M. S.					+	III	+			Enteritis
N. G.	4				+	III	+			Diphtheria
E. E.		+	II	−	+	I	−			
A. M.	1½				+	II	+			Brain tumor
R. M.	1				+	II	−			
M. H.	1				+	II	+			
L. F.					+	II	+			

[1] While baby was at the Preventorium.

and have been referred to us by the tuberculosis clinics, hospitals or charitable agencies. Four have been sent directly from the maternity wards of general hospitals or tuberculosis sanatoria; such babies are excellent cases from our point of view, as they have never been exposed to tuberculosis infection. Of these twenty-eight infants we have lost five: two of diphtheria, one of enteritis, and two of marasmus. This is by no means a discouraging result, especially when we take into consideration the fact that most of these babies would have been infected with tuberculosis and died had they not been promptly removed from their dangerous environment. This mortality rate, however, can be lessened. Deaths from diphtheria may nowadays practically be eradicated from institutions by means of employing the Schick test, which informs us of those who are subject to the disease, and by immunizing all susceptible individuals with toxin-antitoxin mixtures. This procedure has been thoroughly carried out during the past year at an infant asylum with which I am connected, with the result that diphtheria has been eradicated and it is a measure which should be employed in all child caring institutions. A further reduction in mortality can be brought about by having a wet nurse associated with an institution of this kind. When we enlarge our facilities, which I hope will be in the near future, this efficient therapeutic measure will be provided.

A problem which threatened to be perplexing at the inception of this work was the ultimate disposition of the infants at the end of the year when they were ready to be discharged. All would evidently be undone were we forced to return them to their mothers. Nature came to our aid, however, and solved this difficulty for us in a large measure. In eight cases the mother died, and in two cases the father died during the year, so that we were able to transfer the child to a home free from infection. In three instances the mother became an arrested case and was considered a safe guardian. Six babies have been transferred directly to institutions where, according to late information, they continue to thrive. In only two instances have we been at a loss what to do, having to retain one baby overtime at the Preventorium, and return another almost two years of age to its tuberculous mother.

As a result of our two years' experience we do not hesitate to give as our opinion that it is quite possible to save the infants of tuberculous mothers. We feel that we should be more emphatic and state that it is a duty to provide for these infants. From a larger point of view, looking at the question from the standpoint of the welfare of the com-

munity and of the race, it is clear that the protection of infants from tuberculosis has decided advantages over caring for children and adults who are already disabled by disease. As it is now, they are abandoned to their fates, and indeed are the only individuals who are left out of consideration in the tuberculosis propaganda which has spread so rapidly throughout the country. It would seem that if in the course of the next decades we are to make decided progress in our fight against tuberculosis we can only accomplish this by preventing the infection of the coming generation.

Let us take as an illustration the situation of France at the present time. Dr. Hermann Biggs tells us, following his investigation in that country, that there are some hundreds of thousands of tuberculous soldiers and civilians as the result of the war. It is manifestly impossible, as he says, to build and maintain sanatoria for this immense army of tuberculous. The most that can be done is to provide them with good food and fresh air to the best of our ability, and to spread the propaganda of hygiene in order to prevent the further spread of infection. It is clear, however, that these tuberculous people are destined to infect thousands of infants both born and unborn. Is it not desirable in this country as well as in France, not to postpone the solution of this problem for generations, but acknowledging that most of the tuberculous adults are doomed, to make a valiant stand for the protection of the next generation, for the safeguarding of the newborn infants? Unless we take action, we are merely allowing still another generation to be infected with tuberculosis, and transmitting a heavy burden to our successors.

REFERENCE

(1) Hess, A. F. : The neglect to provide for the infant in the antituberculosis program. J. A. M. A., 1914, lxiii, 2176.

ANIMAL EXPERIMENTS IN IMMUNITY AND TREATMENT OF TUBERCULOSIS WITH CELL POISON OBTAINED FROM SPUTUM

WILLARD BOYDEN HOWES

From the Rutland State Sanatorium, Rutland, Massachusetts

The cell poison used in these experiments was obtained by the technique of Vaughan (1).

Instead of using tubercle bacilli obtained by cultural methods sputum was obtained from patients in whom the disease was rapidly progressing and whose sputa showed positive Gaffky 7 to 10. Wide-mouthed bottles, of 400 cc. capacity, were provided such patients for receptacles and large quantities of sputum were collected in this manner.

This gave many strains of virulent tubercle bacilli; also secondary organisms, including streptococci, staphylococci and pneumococci, in small numbers. This sputum was dried by artificial heat. When in powder form it was extracted with alcohol and ether in large Soxhlets, thus removing the fats and waxes.

The cellular substance and debris were then placed in a mortar and broken up by long continuous grinding. After a thorough grinding the cellular substance was placed in flasks with reflux condensers and extracted with twenty times its weight of absolute alcohol containing 2 per cent sodium hydroxide. Five successive extractions were made, using a fresh portion of alkaline alcohol with each subsequent extraction. This separated the cell poison from the cellular substance because of the former's solubility in alkaline alcohol. The cell poison was then carefully neutralized with hydrochloric acid, the sodium chloride precipitate being removed by filtration. The cell poison was evaporated *in vacuo* at or below 40°C. to a point where the cell poison became of a syrupy consistency, dark brown in color, with physical properties nearly identical with Vaughan's cell poison. It took about 800 grams of dried sputum to yield 1 gram of cell poison. Dilutions of cell poison were made with alcohol as diluent in the same manner as Koch's Old Tuberculin is diluted, 1 cc. = 1 gram being the original solution.

Studies in immunity and treatment were then made in the following manner:

IMMUNITY

Eight well nourished pigs were selected and were given diluted cell poison twice a week intramuscularly, the dosage of cell poison being increased with each subsequent injection. This was continued for variable lengths of time, when cell poison was discontinued and the pigs were given injections of a suspension of virulent tubercle bacilli intra-abdominally. The pigs were kept under observation, and those that did not die in seventy-four days were killed by ether injection and autopsied.

TREATMENT

Eight well nourished pigs were selected and inoculated intraäbdominally with a suspension of virulent tubercle bacilli.[1]

In four pigs treatment was instituted twelve days after inoculaton, while in the other four treatment was begun thirty-six days after inoculation. Those that did not die were killed by ether injection one hundred and nine days after inoculation and autopsied.

IMMUNITY EXPERIMENTS

Pig 11: Male, mixed white, black and tan. Received in thigh intramuscularly immunizing dose of cell poison: March 31, 9/5 mgm.[2]; April 4, 8/1 mgm.; April 7, 8/2 mgm.; April 10, pig found dead in pen. Autopsy: no pathological lesions found.

Pig 12: Male, mixed brown and tan. Received in thigh intramuscularly immunizing doses of cell poison: March 31, 9/5 mgm.; April 4, found dead in pen. Autopsy: no pathological lesions found.

Pig 15: Male, angora, tan. Received in thigh intramuscularly immunizing doses of cell poison: March 31, 9/5 mgm.; April 4, 8/1 mgm.; April 7, 8/2 mgm.; April 11, 8/4 mgm.; April 14, 7/1 mgm.; April 18, 7/2 mgm.; April 21, 7/4 mgm.; April 25, 6/1 mgm.; April 28, 6/2 mgm.; May 2, 6/4 mgm. May 5: discontinued cell poison. Gave 0.75 mgm. virulent tubercle bacilli, suspended in physiological saline solution, intraäbdominally. July 15 killed pig by injection of ether. Autopsy: slight enlargement of one right inguinal gland. No other pathological lesions found.

Pig 10: Male, black and tan mixed. Received in thigh intramuscularly immunizing doses of cell poison: March 31, 9/5 mgm.; April 4, 8/1 mgm.;

[1]The tubercle bacillus used was a virulent strain obtained from Dr. E. R. Baldwin, Saranac Lake, N. Y.

[2]9/5 = 0.000000005 mgm.

April 7, 8/2 mgm.; April 11, 8/4 mgm. April 14: discontinued cell poison. Gave 0.003 mgm. virulent tubercle bacilli, suspended in physiological saline solution intraäbdominally. May 2, pig died of a broken neck. Autopsy: nothing pathological found in thorax or abdomen.

Pig 17: Male, white and tan. Received in thigh intramuscularly immunizing doses of cell poison: March 31, 9/5 mgm.; April 4, 8/1 mgm.; April 7, 8/2 mgm.; April 11, 8/4 mgm.; April 14, 7/1 mgm.; April 18, 7/2 mgm.; April 21, 7/4 mgm.; April 25, 6/1 mgm.; April 28, 6/2 mgm.; May 2, 6/4 mgm.; May 5, 5/1 mgm.; May 9, 5/4 mgm.; May 12, 4/2 mgm.; May 16, 3/1 mgm.; May 19, 2/1 mgm.; May 23, 1/1 mgm.; May 26, 1 mgm.; May 31, 10 mgm.; June 2, 20 mgm.; June 6, 50 mgm.; June 10, 80 mgm.; June 13, 100 mgm. June 22, left inguinal glands enlarged and broken down, large ulcerous area in left groin. Discontinued cell poison. June 23, gave 0.75 mgm. virulent tubercle bacilli, suspended in physiological saline solution. August 15, pig killed by injection of ether. Autopsy: left inguinal glands enlarged, with healed ulcerous area; lungs congested. Otherwise normal.

Pig 9: Male, mixed black and tan. Received in thigh intramuscularly immunizing doses of cell poison: March 31, 9/5 mgm.; April 4, 8/1 mgm.; April 7, 8/2 mgm.; April 11, 8/4 mgm. April 14, discontinued cell poison. Gave 0.003 mgm. virulent tubercle bacilli suspended in physiological saline solution intraäbdominally. July 18, pig killed by injection of ether. Autopsy: spleen enlarged and studded with tubercles; lungs contained tubercles; inguinal and axillary glands enlarged; tubercle bacilli found in lung, glands and spleen.

Pig 16: Male, angora, black, tan with white face. Received in thigh intramuscularly immunizing doses of cell poison: March 31, 9/5 mgm.; April 4, 8/1 mgm.; April 7, 8/2 mgm.; April 11, 8/4 mgm.; April 14, 7/1 mgm.; April 18, 7/2 mgm.; April 21, 7/4 mgm.; April 25, 6/1 mgm.; April 28, 6/2 mgm.; May 2, 6/4 mgm. May 5, discontinued cell poison. Gave 0.75 mgm. virulent tubercle bacilli, suspended in physiological saline solution, intraäbdominally. May 25, pig found dead in pen. Autopsy: inguinal and axillary glands enlarged, spleen diminished in size, liver normal, kidneys normal, suprarenals normal, lungs tuberculous.

Pig 13: Male, white and tan. Received in thigh intramuscularly immunizing doses of cell poison: March 31, 9/5 mgm.; April 4, 8/1 mgm.; April 7, 8/2 mgm.; April 11, 8/4 mgm. April 14, discontinued cell poison. Gave 0.003 mgm. tubercle bacilli, suspended in physiological saline solution, intraabdominally. July 18, pig killed by injection of ether. Autopsy: spleen, lungs, liver studded with tubercles; inguinal glands enlarged. No tubercle bacilli found in spleen or glands but numerous pus cells present.

TREATMENT EXPERIMENTS

Pig 5: Male, tan with white face. Inoculated, March 30, with 0.5 cc. suspension of tubercle bacilli in physiological saline solution representing 0.0035 mgm. tubercle bacilli, intraäbdominally. Treatment with cell poison was begun May 5: May 5, 8/1 mgm.; May 9, 8/15 mgm.; May 12, 8/33 mgm.; May 16, 8/5 mgm.; May 19, 7/1 mgm.; May 23, 7/5 mgm.; May 26, 6/1 mgm.; May 31, 6/5 mgm.; June 2, 5/1 mgm.; June 6, 5/5 mgm.; June 10, 4/1 mgm.; June 13, 1/1 mgm.; June 16, 1/5 mgm.; June 20, 1 mgm.; June 23, 5 mgm.; June 28, 8 mgm. July 18, pig killed by injection of ether. Autopsy: site of injection of suspension indurated. Right and left inguinal glands slightly enlarged; axillary glands enlarged. No tubercle bacilli found in glands. Other organs apparently normal.

Pig 6: Male, white. Inoculated, March 30, with 0.5 cc. suspension of tubercle bacilli in physiological saline solution representing 0.0035 mgm. tubercle bacilli, intraäbdominally. May 5, treatment with cell poison instituted. May 5, 8/1 mgm.; May 9, 8/15 mgm.; May 12, 8/3 mgm.; May 16, 8/6 mgm. May 16, pig found dead. Autopsy: inguinal and mediastinal glands enlarged. Otherwise nothing pathological found.

Pig 7: Male, angora, mixed black and white. Inoculated, March 30, with 0.5 cc. suspension tubercle bacilli in physiological saline solution representing 0.0035 mgm. tubercle bacilli intraäbdominally. April 7, pig found dead in pen. Autopsy: intestinal obstruction cause of death.

Pig 4: Male, tan. Inoculated, March 30, with 0.5 cc. suspension of tubercle bacilli in physiological saline solution representing 0.0035 mgm. tubercle bacilli intraäbdominally. Treatment with cell poison was begun May 5. May 5, 8/1 mgm.; May 9,8 /15 mgm.; May 12, 8/33 mgm.; May 16, 8/5; May 19, 7/1 mgm.; May 23, 7/5 mgm.; May 26, 6/1 mgm.; May 31, 6/5 mgm.; June 2, 5/1 mgm.; June 6, 5/5 mgm.; June 10, 4/1 mgm.; June 13, 1/1 mgm.; June 16, 1/5 mgm.; June 20, 1 mgm.; June 23, 5 mgm.; June 28, 8 mgm. July 17, pig killed by injection of ether. Autopsy: no apparent signs of tuberculosis. Inguinal glands enlarged to size of buck shot.

Pig 3: Male, white angora. Inoculated, March 30, with 0.5 cc. suspension of tubercle bacilli in physiological saline solution representing 0.0035 mgm. intraäbdominally. April 11, treatment with cell poison begun. April 11, 8/1 mgm.; April 14, 8/15 mgm.; April 18, 8/22 mgm.; April 21, 8/33 mgm.; April 25, 7/1 mgm.; April 28, 7/15 mgm.; May 2, 7/33 mgm.; May 5, 6/1 mgm.; May 9, 6/22 mgm.; May 12, 5/1 mgm.; May 16, 5/15 mgm.; May 19, 5/5 mgm.; May 23, 4/1 mgm.; May 26, 3/1 mgm.; May 31, 2/1 mgm.; June 2, 1/1 mgm.; June 6, 1/5 mgm.; June 10, 1 mgm.; June 12, 10 mgm.; June 16, 50 mgm.; June 20, 100 mgm.; June 23, 150 mgm.; June 28, 200 mgm. July 8, pig found dead in pen. Autospy: axillary and inguinal glands markedly

enlarged. Spleen diminished in size; both kidneys enlarged and congested. Border of liver inflamed. Lungs slightly congested.

Pig 2: Male, mixed dark brown and tan. Inoculated, March 30, with 0.5 cc. suspension of tubercle bacilli in physiological saline solution representing 0.0035 mgm. tubercle bacilli intraäbdominally. April 11, treatment with cell poison begun. April 11, 8/1 mgm.; April 14, 8/15 mgm.; April 18, 8/22 mgm.; April 21, 8/33 mgm.; April 25, 7/1 mgm.; April 28, 7/15 mgm.; May 2, 7/33 mgm.; May 5, 6/1 mgm.; May 9, 6/22 mgm.; May 12, 5/1 mgm.; May 16, 5/15 mgm.; May 19, 5/5 mgm.; May 23, 4/1 mgm.; May 26, 3/1 mgm.; May 31, 2/1 mgm.; June 2, 1/1 mgm.; June 6, 1/5 mgm.; June 10, 1 mgm.; June 13, 10 mgm.; June 16, 50 mgm.; June 20, 100 mgm.; June 23, 150 mgm.; June 28, 200 mgm. July 17, pig killed by injection of ether. Autopsy: inguinal glands enlarged. Lower lobes of left and right lungs congested. Otherwise nothing pathological found.

Pig 1: Male, gray with brown belly. Inoculated, March 30, with 0.5 cc. suspension of tubercle bacilli in physiological saline solution representing 0.0035 mgm., intraäbdominally. Treatment with cell poison begun April 11. April 11, 8/1 mgm.; April 14, 8/15 mgm.; April 18, 8/22, mgm.; April 21, 8/33 mgm.; April 25, 7/1 mgm.; April 28, 7/15 mgm.; May 2, 7/33 mgm.; May 5, 6/1 mgm.; May 9, 6/22 mgm.; May 12, 5/1 mgm.; May 16, 5/15 mgm.; May 19, 5/5 mgm.; May 23, 4/1 mgm.; May 26, 3/1 mgm.; May 31, 2/1 mgm.; June 2, 1/1 mgm.; June 6, 1/5 mgm.; June 10, 1 mgm.; June 13, 10 mgm.; June 16, 50 mgm.; June 20, 100 mgm.; June 23, 150 mgm.; June 28, 200 mgm. July 17, pig killed by injection of ether. Autopsy: inguinal glands slightly enlarged. Otherwise normal.

CELL POISON CONTROLS

Pig 14: Male, tan with white nose. Received in thigh intramuscularly cell poison as follows: March 31, 9/5 mgm.; April 4, 8/1 mgm.; April 7, 8/2 mgm.; April 11, 8/4 mgm.; April 14, 7/1 mgm.; April 18, 7/2 mgm.; April 21, 7/4 mgm.; April 25, 6/1 mgm.; April 28, 6/2 mgm.; May 2, 6/4 mgm. June 7, pig died; previous to his death frequent twitchings and convulsive-like motions were observed, with loss of weight. Autopsy: emaciated. All organs normal except spleen, which was about four times its normal size. Lungs and heart normal. One left axillary gland enlarged.

Pig 18: Male, tan. Received in thigh intramuscularly cell poison as follows: May 12, 100 mgm.; May 16, 200 mgm.; convulsive attacks five minutes after each injection, followed by paralysis of legs lasting about twelve hours. July 15, pig killed by injection of ether. Autopsy: emaciated. Right lung, nodular area near surface. Otherwise normal.

TREATMENT CONTROL

Pig 8: Female, angora, brown and tan. March 30, inoculated with 0.5 cc. suspension of tubercle bacilli in physiological saline solution representing 0.0035 mgm., intraäbdominally. No treatment given. July 17, pig killed by injection of ether. Autopsy: lungs and spleen tuberculous. Inguinal and mediastinal glands enlarged.

Pig 19: Male, white, angora. March 30, inoculated with 0.5 cc. suspension tubercle bacilli in physiological saline solution representing 0.0035 mgm. intraäbdominally. No treatment given. June 6, pig found dead. Autopsy: liver, lungs and axillary glands tuberculous.

CONCLUSIONS

Immunity experiments. The resistance in pigs 15, 10 and 17 to tubercle bacilli was apparently increased by immunizing doses of cell poison.

In pigs 9 and 13 cell poison was discontinued too early to establish any degree of immunity.

Treatment experiments. At autopsy pigs 5, 6, 4, 3, 2 and 1 showed fewer pathological findings then did control pigs 8 and 19 not receiving treatment, suggesting a possible beneficial action of cell poison in supporting the combating forces.

Cell poison in small repeated doses and in large doses had similar deleterious effects upon control pigs.

The results of these experiments warrant a more thorough investigation, especially of the therapeutic value of cell poison obtained from sputum.

I wish to acknowledge the valuable assistance given in this experimental work by the late Rudolph Ertischek, former bacteriologist of the Rutland State Sanatorium.

REFERENCE

(1) VAUGHAN, V. C.: Protein Split Products in Relation to Immunity and Disease. Lea & Febiger, Philadelphia, 1913.

EDITORIAL

REST

Elsewhere in this issue of the REVIEW there appears a paper by Joseph H. Pratt[1] of Boston, the title of which will excite the reader's impatience or admiration according as he considers it the function of a medical publication to give space only to what was never said before or to what is important enough to bear skilful repetition—incessant reiteration without irritation.

Nevertheless, until the time comes when every tuberculous patient, upon being asked what is the most important element in the treatment of tuberculosis, will unhesitatingly answer, "Rest!", the subject will always be timely. This happy day has not yet arrived. To-day, almost thirty-three years after Trudeau set down his first patient on the small porch of the Little Red, "fresh air" and "putting on weight" still dominate the therapeutic field—at least in the minds of nine out of ten patients. Few patients consult their physician about staying out of doors; relatively few, unless they suffer from indigestion, about eating enough; but before completing a "cure" practically every patient takes up the matter of rest with the medical attendant at least once. We have the *Journal of the Outdoor Life*, and any number of "health" periodicals that print page upon page on diet and exercise. So far as the writer knows there is no publication devoted to "Rest." Yet who is there among us that would not sooner put his money on the tuberculous patient living at perfect rest—physical and mental rest—in a close room rather than on a similar individual wielding a pick and shovel beyond his capacity in all outdoors?

There can be no doubt that with acute respiratory disease, strain makes up a team of immediate etiological factors that is responsible for more individual outbreaks of tuberculosis than any other single cause. Whoever believes that preëxistent benign tubercle develops, in a vast number of instances, into clinical tuberculosis, and at the same time tries to appreciate what may happen to such benign tubercle under strain or

[1]The importance of long continued rest in the treatment of pulmonary tuberculosis. Am. Rev. Tub., 1918, i, 637.

intercurrent respiratory disease will have no difficulty in understanding why this is so. Both in anatomic and physiological disturbance the circumtubercular effects of strain and intercurrent disease can be identical, and the ultimate results the same—the conversion of a relatively insignificant formation into a menace. It is the writer's opinion that no one can deny the influence of strain on the production of tuberculous disease, and for this reason he has always been amazed that everyone will not face squarely the issue of relief from strain in the therapy of tuberculous disease and give it the prominence it deserves.

For what is rest but relief from strain? And where shall we place it in therapy, if not first, and always first? It is, of course, conceivable and, indeed, highly probable that rest may mean all things to all men. It may mean the sloth of the indolent or the relief from tension that follows change of occupation. The t. b. m. might seek his rest in a "night out;" the wornout housewife, on a shopping tour. The views of a certain ex-President and a certain R. L. S. would probably differ widely as to what is rest. To some of us it has always seemed a marvelous commentary on the reasoning intricacies of the human mind that we send a worked-out horse to the pasture to vegetate while for the broken business man we prescribe a sweating course of handball at the gymnasium. These considerations simply go to show that rest is perhaps a relative state of consciousness to which different constitutions and temperaments will react differently. But in this clash, this welter, of individual physical and mental reactions, is it not possible to find common ground? Let us put the matter another way: Instead of saying "rest" let us say "relief from strain." Let us then put the matter thus—that relief from strain is any state of physical or mental activity or inactivity that does not reach the point of conscious fatigue; and by fatigue we would include *ennui*.

Is not this the main, the guiding, one is almost tempted to say, the only principle to be followed in tuberculosis therapy? The febrile, acutely ill must of course, always be put to bed: there can be no question about this. But the vast number, the majority, of the tuberculous sick, those who are sitting out their time awaiting the day that will take them back to the land they came from—what of them? For them tuberculosis regimen should mean exactly what we have just said: anything congenial that keeps the patient below the fatigue line. And this the physician cannot prescribe in terms of minutes or of hours. The fatigue line is an individual affair, registered only in the patient's own consciousness.

The patient has his "cure" in his own hands. He who heeds will succeed, if success is possible: he who is unresponsive or refractory, may fail. For the tuberculous, fatigue is the flash from the focus and he who acknowledges the message by immediately throwing on the brakes is the patient whom we can appoint engineer of his own case. The patient who never pushes himself to the point of fatigue or who at once stops short when it is upon him will never delay his "cure" by any measures within his control, but will hasten it with geometrical ratio. The man who will not stop is a poor risk, no matter what the nature of his case may be.

This, in the writer's opinion—this always keeping below the point of fatigue—is all that there is to the matter of rest in the therapy of tuberculosis; and when he says "all that there is to the matter of rest," he means everything in the routine therapy of the disease. All other measures ever advocated in its treatment will not begin to counterbalance the violation of this single rule of rest or exercise—never become tired, or if tired, rest, and *rest until completely refreshed.*

And what under the circumstances is our duty as physicians? It is this: to explain to the patient why relief from strain is so important, to explain too that there can be no set formula for all patients nor one even for the individual, that rest can be measured only by a conscious reaction on the patient, that therefore the patient must rely on his own intelligence and behavior in the treatment of his case, and that meanwhile he, the physician, is always at hand, a guide and mentor, to help out in the little details of management and to give the patient all the support and comfort that a rich and wide experience can bestow in relieving the tedium of the protracted fight at hand. But, above all, to so engrave rest on the patient's mind that he will automatically at once respond with rest to the first symptom of fatigue.

A. K. K.

MEDICAL NOTES, ABSTRACTS AND REVIEWS

It will be the eventual purpose of the REVIEW thoroughly to canvass all literature on tuberculosis as it appears in other medical periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the Abstract Editor, Dr. George Mannheimer, 41 West 51st Street, New York, N. Y.

Roentgenography of Lungs.—A method is described by which shadows cast by the air passages of the lungs may be unequivocally defined in roentgenograms. This method consists of injecting into the trachea a 10 per cent suspension of iodoform in olive oil, which renders the air passages opaque to the rays. The limit of a safe dose of this emulsion for dogs is found to be approximately 4 cc. per kilogram of body weight. The plates are made by an instantaneous exposure by a soft vacuum tube placed above the animal. As similar suspensions of iodoform in oil have been used for the local therapy of human pulmonary diseases, it is hoped that the perfection of the method may ultimately permit its application to man. This preliminary study is the basis of the belief of the authors that by such a method it may become possible to define with precision many radiographic shadows which are at present largely data for speculation.—*Roentgenography of the Lungs. C. A. Waters, S. Bayne-Jones, L. G. Rowntree, Arch. Int. Med., April 16, 1917*, 19, *no. 4, 538.*

Sputum Cultures in the Diagnosis of Pulmonary Tuberculosis.—Petroff's method is superior to Griffith's, and his medium is slightly superior to Williams-Burdick's medium and much better than Dorsett's for obtaining cultures of tubercle bacilli directly from sputum. The high percentage, 90 per cent, of positive findings obtained by various workers cannot be obtained constantly. A microscopically positive sputum may be negative by culture. On the other hand, sputum culture will reveal the presence of tubercle bacilli when none are found microscopically, whether there be doubtful or distinct signs and symptoms. There is danger of dissemination of the disease by tuberculous patients whose sputum is negative by microscope.

Pulmonary blastomycosis and pulmonary infections with other forms of higher bacteria simulating tuberculosis are not common. Few if any of the cases diagnosed as tuberculosis are cases of blastomycosis.—*The Value of Sputum Culture in the Diagnosis of Pulmonary Tuberculosis. J. A. Roddy, N. York M. J., July 21, 1917, cvi, no. 3, 108.*

Complement Fixation Test for Tuberculosis.—A positive test indicates active tuberculosis, therefore affords valuable diagnostic and prognostic information. Fifty-nine cases of clinical tuberculosis were studied. Of these 55 gave a positive and 4 a negative reaction. Of 40 cases of clinical tuberculosis with negative sputum 95 per cent gave a positive test. By this test more cases of tuberculosis can be recognized than by all of the other available means. However it gives no data regarding the location and very meagre information as to the extent of tuberculous foci in the body. A positive reaction without clinical data gives no prognostic information.

Tuberculosis and syphilis are frequently associated, and the latter is probably a predisposing cause in tuberculosis.—*The Complement Fixation Test for Tuberculosis and the Wassermann Test in Pulmonary Tuberculosis. J. J. Singer, J. of the Missouri State M. Ass., July 1917, vxlv, no. 7, 284.*

Complement Fixation.—The authors speak of the results of different workers and the variations that are seen in regard to the estimated value of this test for which Miller and Zinsser of New York claim an accuracy of nearly 100 per cent, using an antigen made up of ground tubercle bacilli in physiologic salt-solution which is thus prepared and used: Twenty mgm. of the moist tubercle bacillus mass are weighed out, placed in a conical 15 cc. centrifuge tube, and to it are added 90 mgm. of table salt. With a glass rod, filed to roughness at the end, this paste is ground by hand for about one hour. Distilled water is then added to isotonicity, that is, 10 cc. to the quantities described above.

This is the antigen. Just before using, it is shaken up and the heavier particles are allowed to settle in the course of a few minutes. Except for the removal of these larger elements, the suspension is used as a whole without centrifugation and without filtration. It seemed to them that it would be of interest and value to retest the Miller antigen and in some cases Petroff's antigens 1, 2 and 3 which, however, did not give as good results as Miller's. Two series of experiments were made with the Miller antigen, first of specimens of patients with known tuberculosis so as to familiarize the laboratory men with the expected reactions while the second series was to consist of specimens of all grades of the disease, from nontuberculous, and from doubtful cases. The last class will provide some indication as to the test for specificity. The blood specimens were taken from patients and employees at the North Reading State Sanatorium. There were seventy-seven known tuberculous patients and the results in the far and moderately advanced are given in tabulated form. The far advanced gave on an average the weakest reaction, while the advanced cases gave a much larger proportion and over one-half of the still earlier cases gave a strongly positive record. The evidence seems to favor the belief that the amount of complement-fixing bodies in the blood may measure the patient's resistance against the disease. In a second table, the relation of results to the clinical condition in the seventy-seven cases is also given and analyzed. In the second group of specimens, of all grades of tuberculosis including normal patients, seventy-eight in number, there were three out of nineteen designated as probably nontuberculous and gave a strong reaction and they assume that they may have active lesions not shown by the physical examination. Since the Wassermann test is a routine method in the Boston Health Department Laboratory, it was decided to test all serums submitted for this specific test with the tubercle bacillus antigen. "In this way some light might be thrown on the matter of cross-fixation. A total of 912 such tests was made. Of these 221 were positive and 691 were negative for the Wassermann reaction. Of the 221 positive Wassermann tests, complement fixation for tuberculosis gave 21 positive, 13 moderately positive, 16 delayed negative, and 171 straight negative. Of the 691 negative Wassermann tests, 55 reacted positively for tuberculosis, 35 moderately positive. There were 21 delayed negative and 580 negative reactions. We are unable to obtain clinical histories in many of these cases to confirm the specificity of the tuberculosis reactions; but the evidence seems conclusive that there is no cross-fixation with syphilitic serums." The authors conclude that it appears that the test is specific for tuberculosis but perhaps the number of tests of nontuberculous cases is too few for a definite statement. It is not to be expected that it will replace the ordinary examination of the sputum, but that it will prove of great value as an aid to diagnosis in cases showing congestive physical signs when there is no positive demonstration of tubercle bacilli in the sputum. The positive complement-fixation test would be strong evidence, but while a single negative would be inconclusive, several would indicate that active tuberculosis was not present. It will also be useful to determine whether a clinically arrested case has still an active focus existing.—*Application of the Complement-Fixation Test to Tuberculosis. N. B. Burns, F. H. Slack, P. Castleman and P. Bailey, J. Am. M. Ass., May 12, 1917, lxviii, no. 19, 1386.*

Complement Fixation with Partial Antigens.—Partial antigens have been prepared from the tubercle bacillus, by disintegrating the bacilli in one per cent lactic acid, filtering, and extracting the residue with alcohol at 0°C., 37°C., 56°C., 78°C., and with ether. The resulting antigens appear to be composed chiefly of the various fatty acids, and neutral fat of the tubercle bacillus together with traces of protein.

One hundred and seventy-six normal and tuberculous sera were titrated against these partial antigens, and against whole bacillus emulsion antigen. Seventy-two of the sera obtained from clinically normal cases, and 91 per cent of the sera from cases classed clinically as inactive tuberculosis reacted negatively to these antigens. Ninety per cent of the sera from cases classed clinically as incipient tuberculosis, 87 per cent of the sera from cases classed as active tuberculosis, and 92 per cent of the sera from advanced tuberculous cases reacted positively to the partial antigens.

Sufficient syphilitic sera could not be obtained to make any determination of the proportion of syphilitic sera which would react positively to these antigens. Judging from 27 positive Wassermanns obtained at the same time the sera were examined, there appears to be little relationship between the Wassermann reaction and the reaction to the partial antigens.—*Complement Fixation in Tuberculosis with the "Partial Antigens" of Deycke and Much. A. Woods, G. E. Bushnell and C. Maddux, J. of Immunol., April, 1917, ii, no. 3.*

Review of Complement Fixation.—The principal difficulty in complement fixation in tuberculosis has been the procuring of a proper antigen. The antigens tried by various observers fall into four groups: (1) Antigens in which the whole tubercle bacillus was used, including all the strains as well as allied acid-fast bacilli. (2) Tuberculins. (3) Tubercle bacillus derivatives or extracts, to which the partial antigens of Deycke and Much belong. (4) Antigens produced from tuberculous tissue; also from normal tissue.

Various results have been reported by different investigators, some of which were favorable with whatever antigen employed. With the exception of group 4, good results have been obtained with either group. Recently Miller and Zinsser have employed an antigen prepared by triturating living or dead bacilli with dry crystals of ordinary table salt, then adding distilled water up to isotonicity. Of 232 clinically active cases with positive sputa, all but three gave positive fixation with this antigen. Of 90 inactive or healed cases, 83 were negative. The reaction was positive in 7 patients, five of whom had tubercle bacilli in the sputum shortly before the test. In 140 doubtful cases, the reaction was positive in 32; in some of these the diagnosis was confirmed later. Forty-three positive Wassermann cases gave no fixation with tubercle bacillus antigen; two cases were fixed with both antigens, in one of which the coexistence of both diseases could be proved. One hundred and three non-tuberculous cases were all negative.—*A Review of the Complement Fixation Test in Tuberculosis. H. R. Miller, J. Lab. & Clin. M., i, no. 11.*

Complement Fixation in Tuberculosis.—The authors call attention to the lack of uniformity in the observations of different observers and the fact that only a few go far enough into the work to compare a number of different antigens. One of these is Elizabeth Frazer, who concludes that the one giving the clearest specific reaction and the most reliable is an emulsion of living virulent tubercle bacilli. There is a lack also of detailed descriptions of the methods of preparation of the different antigens. This is especially true of the egg medium antigen of Besredka and the alcoholic antigen of Craig. Workers on complement fixation have been startled by the wonderful results reported by H. R. Miller whose antigen seems to be no more or less than a bacillary emulsion. The method of preparation, however, was clearly given and thus comparisons are possible. Miller concludes that the reaction of his antigen is practically always positive in active tuberculosis. Corper has in previous communications described an autolysate antigen and reported the results obtained by means of a monovalent autolysate antigen compared with those obtained with the same monovalent bacillary emulsion. The former was more stable and constant in preparation and gave more clear cut reactions, and in general the statements of Miller were supported. It is always advisable to do a Wassermann test on the same serum with a standard antigen (not cholesterinized or reinforced) and if this is positive no conclusions can be drawn as to the tuberculosis test, but with a positive Wassermann reaction absent, a positive tuberculosis test is significant. They describe their observations in comparing this autolysate with the Miller test and give the results in tabulated form. Their summary is given as follows: A comparison of complement fixation tests for tuberculosis on 237 serums, the autolysate and Miller's bacillary antigen being used, revealed that: "1. There is not a great deal of difference between the positive results obtained by means of these antigens, probably because the same basic substances are used in the two antigens. 2. It is impossible by means of this test absolutely to differentiate active from inactive tuberculosis, the former cases giving a slightly higher number of positive reactions than the latter. 3. The autolysate antigen is to be preferred in performing these tests on account of the more transient nature of the results obtained with Miller's bacillary antigen and the difficulties encountered in obtaining a satisfactory antigenic unit. 4. It is advisable to run a Wassermann reaction on the same serum, using one of the standard antigens (not reinforced or cholesterinized), and in the presence of such positive reaction to draw no conclusions from the tuberculosis test. 5. The positive complement fixation test for tuberculosis in the absence of a positive Wassermann reaction is mainly of differential diagnostic value, and, taken with other findings, aids in making a definite diagnosis of tuberculosis."—*Complement Fixation Tests in Tuberculosis: A Comparison of the Autolysate Antigen and Miller's Bacillary Antigen. H. J. Corper, H. C. Sweany, J. Am. M. Ass., June 2, 1917, lxviii, no. 22, 1598.*

Syphilis and Tuberculosis.—For the purpose of determining the frequency with which syphilis is associated with tuberculosis and to direct those found luetic to general dispensaries for treatment of that condition, thereby possibly improving their tuberculous state, Wassermann blood tests were made on

175 tuberculous patients at Corlears Tuberculosis Clinic. The findings are classified as follows:

Wassermann Tests: Cases with four plus reaction, 12; with three plus reaction, 2; with one plus reaction, 7; with negative reaction, 154; total, 175.

Fifty-two of the patients had tubercle bacilli in their sputum; of these five gave a strongly positive Wassermann reaction.

One hundred and sixteen patients had no tubercle bacilli in their sputum; of these, 15 gave a positive Wassermann reaction, the cases being about equally divided among four plus, three plus, and one plus reactions.

Subsequent clinical findings confirmed the diagnosis of syphilis in all cases that gave a strongly positive Wassermann reaction and in some of those that were reported weakly positive. So far as could be learned, the beginning of the luetic affection invariably preceded that of the clinically associated tuberculosis. All of the positive Wassermann cases were referred to general dispensaries for observation of their syphilitic condition and for anti-syphilitic treatment. As many with active pulmonary lesions and negative sputum gave a positive Wassermann reaction, with and without clinical evidence of syphilis, the possibility of pulmonary syphilis was not lost sight of, later developments proving, in at least two instances, the probable existence of that condition. The effect of the anti-syphilitic treatment upon the tuberculous process in the luetic cases has, thus far, been encouraging. These findings are corroborative of results obtained by other observers, and again emphasize the need of a more general use of the Wassermann test in tuberculous patients.—*Weekly Bull., Dept. of Health, N. Y. City, June 30, 1917.*

Osmosis in the Treatment of Tuberculosis.—To the methods in use in the treatment of tuberculosis, may be added those measures which promote osmotic activity. Merely to say that the tuberculous individual is run down or has lowered resistance, is ambiguous and unscientific. It is much nearer the truth to say that the tuberculous patient has an impaired osmosis. Whenever the normal osmotic activity in the body becomes impaired, all of the dependent physiological processes suffer a corresponding reduction. As a result the susceptibility to infection is increased. Bacteria attack the quiescent tuberculous foci and arouse them to activity. Sooner or later symptoms are produced, and it is discovered that the patient has incipient tuberculosis.

In view of the fact that osmosis is largely dependent upon a high degree of fluidity in the solvents of the body, any measure which promotes fluidity in the body will increase osmosis, and consequently tend to restore the normal balance of the body functions. As a result the general tonicity of the body is improved, and the degree of resistance to infection is increased. Water accomplishes this with the greatest ease, not mineral waters, but pure or warm aerated distilled water. It is impossible to determine accurately the quantity of water each person requires; yet, a valuable index is the specific gravity of the urine, which should be about 1008.

Efforts devoted to an improvement of osmosis should not constitute the only treatment in tuberculosis. They must be carried out faithfully and for a long time.—*Osmosis, A Factor in the Treatment of Tuberculosis P. S. Bailey, Med. Rec., July 14, 1917, xcll, No. 2, 55.*

Treatment of Pulmonary Hemorrhage.—Attention to hygienic details, except in the severer forms of hemorrhage, is more important than the use of drugs. With the patient recumbent, it is advisable to elevate the head or shoulders in order that the force of gravity may aid in drawing the blood from the pulmonary circulation to the lower half of the body as well as for the purpose of avoiding dyspnea. Speaking above a whisper should be interdicted, muscular effort should be restricted and visits of relatives and friends discouraged. The room should be kept at an equable temperature, the bowels evacuated daily without effort, and retching and vomiting carefully avoided. Small pellets of ice may be given to advantage. The diet should be liquid and administered through a tube. The employment of calcium has not been attended with the results expected. It should not be given for longer than a few days without interruption. Gelatin is best given by mouth in the form of jelly suitably flavored. Of the coagulants, however, horse serum has proved of more value. It should be given subcutaneously in 15 to 30 cc. doses and repeated if necessary but not continued for longer than ten days. It is contraindicated where there is a history of diphtheria treated with antitoxin, administration of serum for previous hemorrhage, or in cases of so-called "horse asthma." It is of most value in "weeping hemorrhages." Salt also acts as a coagulant, though its action is not long sustained. It is given best by intravenous injection, using 5 cc. of a 10 per cent solution in normal saline once or twice a day, taking care that none of the fluid escapes into the tis-

sues. The value of emetine has not been definitely established, although good results have been reported. The nitrites have proved of value in cases of hypertension, as it has been shown that they cause a constriction of the pulmonary vessels. Adrenalin and pituitrin are lately being discarded in the treatment of this condition. Morphine is still widely used and is very valuable, especially in severe cases where a sedative is indicated. It should later be replaced by the bromides for the sedative effect. Atropine also seems beneficial in severer hemorrhages, but ergot should not be used as it has been shown to increase the tension in the lesser circulation.

Of the special measures employed in the control of hemorrhage, artificial pneumothorax is extensively resorted to. The only difficulty in this method consists in the uncertainty regarding which lung the bleeding comes from, since it has been demonstrated post-mortem that in bilateral tuberculosis the hemorrhage often comes from the lung least affected. When practiced for this condition a fairly high degree of intrapleural pressure should be produced in order to collapse the bleeding area with greater certainty. Strapping the chest while of questionable efficacy is harmless and may be employed without causing disturbance to the patient. The ice bag over the supposed site of the hemorrhage as well as over the precordium, where there is rapid heart, is another common practice. Some advocate venesection, hypodermoclysis and saline intravenous infusions. The latter measures are suitable for cases of severe bleeding, where there is danger of exsanguination.—*The Treatment of Pulmonary Hemorrhage. D. C. Martin, N. York, M. J., Oct. 20, 1917, cvi, no. 16, 738.*

Operations for Pulmonary Tuberculosis.—Bull's eleven cases of extrapleural thoracoplasty have convinced him that the general practitioner should not fail to give his patients the chance of recovery offered by these operations in suitable cases. That is, when a unilateral or predominantly unilateral tuberculous process is not cured by rational expectant treatment, including induced pneumothorax. Good results in such cases still may be obtained with an extrapleural operation on the chest wall. He works under paravertebral or local anesthesia, after giving 0.01 gram morphin subcutaneously an hour and again fifteen minutes beforehand. He describes the incision and the technic with which he resects nine ribs to a total of 150, 160 or 183 cm. The operation is easier on women than on men as the ribs are thinner and they can be stripped more easily than in men. Four of his eleven patients were clinically cured; two have succumbed since to the progress of the disease, and three died from postoperative pneumonia or infection or both. One patient has been much improved during the few months to date, and one seemed to be benefited at first but died two years later with symptoms of intestinal tuberculosis. The fact that four or five apparently doomed, progressing cases were arrested and the patients restored to health and happiness justifies this extrapleural resection of the posterior portion of the ribs from the tenth and eleventh up to and including the second.—*Erfaringer om ekstra-. pleural torakoplastik Pf. Bull, Norsk Mag. Laegevidensk., March 1917, lxxvii, no. 3, 281.*

Unilateral Extraction of Intercostal Nerves in Pulmonary Disease.—The effect of experimental paralysis of the intercostal nerves on the movements of the corresponding lung was studied in rabbits. Through a longitudinal incision at the external border of the erector spinae muscle, under local anaesthesia, the first eleven intercostal nerves were exposed and divided after separation from the pleura. This was done distal to the giving off of the dorsal branch which supplies the back muscles. The distal portion of the intercostal nerve was removed by tearing it out (neurexairesis). The 12th intercostal nerve was not removed, because it does not innervate the respiratory muscles of the chest wall. The unilateral exclusion of chest movements by means of so paralyzing the intercostal muscles quieted and collapsed the corresponding lung. The author argued that this ought to favorably affect a tuberculous process in the lung and promote its healing. He therefore did a similar operation on two patients with pulmonary tuberculosis. The operation is simple, and secondary complications need not be feared.—*Der Einfluss einseitiger Extraktion der Intercostalnerven auf die Lungen und ihre tuberkuloese Erkrankung, Warstat, Deutsch. Zitschr. f. Chir. 1917. cxxxviii.*

Iodin in Treatment of Tuberculosis.—Boudreau reiterates that iodin has an actual curative action in many cases of pulmonary tuberculosis, but it has to be given properly. The patient must be gradually accustomed to it, taking it fractioned into as many doses as possible during the day. He commences with one drop of tincture of iodin repeated six or seven times during the day, adding this drop to the usual beverage at the meals. The next day two drops are given at each dose, the third day three drops,

and so on, gradually increasing to thirty, sixty, ninety drops or more, according to the way the stomach bears it and the individual need for it. He has patients who finally reach doses of several hundred drops and keep this up for months or even years. He has never had any real inconveniences with this method of treatment. Iodism is encountered with iodids, not with iodin. He is convinced that the tuberculous do better at home in the long run, under the surveillance of their physicians, than in the hospital. The iodin treatment can be applied better in the home, and he urges its systematic application. The asphyxiating drift gases of modern warfare have been an important factor in the recrudescence of tuberculosis in the trenches. (The French tincture of iodin contains one part of iodin to twelve parts of alcohol.)—*Tuberculose de guerre et Jode, L. Boudreau, J. de Med. de Bordeaux June, 1917, lxxxviii, no. 7, 129.*

Intravenous Calcium Solutions in Pulmonary Tuberculosis.—In no other condition does the organism use calcium so uniformly in walling off disease areas as in pulmonary tuberculosis. Since there is a deficiency of calcium in the blood in tuberculosis, the use of it in the treatment of the disease is quite logical. The oral administration of calcium is of some value, but it soon causes gastric derangement. Furthermore we cannot be sure that a sufficient amount reaches the blood. For these reasons the intravenous use of calcium is to be preferred. The object of its use is to saturate the blood with an amount of calcium which is about the normal percentage. In adjusting the dose the body weight must be considered. Some patients can tolerate larger amounts than others. The coagulation time of the blood also aids in the dosage. As a rule the clotting time is reduced after each fifth injection. Begin with a dose of 1 grain, gradually increase till a maximum of 6 grains, then decrease the dose slowly until an amount is given which will maintain the coagulation time at normal or slightly below normal. Injections can be continued from six months to a year. The results in a majority of cases are good. Out of 120 cases 40 were apparently cured, 21 improved, and in 18 the disease was arrested.—*The Intravenous Use of Calcium as an Aid in the Treatment of Tuberculosis, T. J. Beasley, N. York, M. J., July 21, 1917, cvi, no. 3, 116.*

Nastin-Chinolin-Treatment.—Nastin is supposed to dissolve the waxy coat of the tubercle bacilli, the chinolin-sulphate to kill the liberated bacilli. Nastin is given intravenously in 1 per cent soft soap-solution in quantities of 0.25 to 1 cc.; the chinoline-sulpahte is administered in 5 per cent watery solution, 5 to 10 cc., into the glutaeal muscles, antipyrin being added to make the injection painless. The author gives the histories of 52 cases thus treated. The result was as follows: (1) Lowering of the temperature; (2) improvement of the physical findings; cessation of cough and expectoration; disappearance of tubercle-bacilli from the sputum; (3) tuberculous lymph-nodes heal spontaneously; (4) ulcerations in larynx and nose granulate and cicatrize; (5) the hemoglobin increases and the leucocytes go up to 35,000; (6) the weight increases considerably.—*Zur Tuberkulosebehandlung, Evers, Berl. Klin. Wochenschr.* 1916, *no. 43* (*Transl. Intern't. Centralbl. f. d. ges. Tuberk. Forsch.*)

Ether Treatment of Tuberculosis.—Ether, given by the closed cone method, is a valuable therapeutic agent in the treatment of peritoneal, pulmonary and meningeal tuberculosis. Improvement is noticeable as soon as the patient recovers from the anesthetic. Ether is of greatest benefit when used in uncomplicated tuberculous peritonitis and early pulmonary tuberculosis. One anesthesia usually suffices, In advanced cases of pulmonary tuberculosis the distressing symptoms of high fever, cough, expectoration, night sweats, loss of sleep and appetite are very noticeably benefited for a period of from fifteen days to six months. In advanced cases continued improvement has been noticed, not infrequently, with repeated anesthetics. Ether cones can be made of a towel, heavy wrapping paper, and three safety-pins. In the apex of the cone a pledget of absorbent cotton is placed. A few drops of ether are at first poured into the cone to allow the patient to become accustomed to the fumes. Then it is gradually increased until the stage of excitement is reached, when a liberal supply is added and the cone kept snugly against the face, reinforced with a towel to exclude as much oxygen as possible. In this way the patient can be kept under as long as one thinks necessary.—*Treatment of Tuberculosis by Ether Anesthesia, W. E. Savage, Ohio State M. J., July 1917, xiv, no. 7.*

Goat's Milk Therapy.—Levy is not impressed with the evidence of the therapeutic value of goat's milk. He asserts that antibodies specific to the tubercle bacillus are probably present in the goat's blood, that they are likely secreted in the

milk, and apparently can pass unaltered through the intestinal wall into the blood when taken by mouth. These antibodies are probably present in the milk in very small amounts and, in order to be of any value, would require enormous quantities of milk to be ingested before their influence would become noticeable. Its use as a routine measure is therefore impracticable if not valueless.—These calculations are based on observations made in Sea View Hospital, New York City.—*Goat's Milk Therapy in Tuberculosis, M. Levy, St. Paul M. J., November, 1917, xix, no. ii, 336.*

Artificial Pneumothorax.—Small quantities of air—200 to 300 cc.—every few days are used until a satisfactory collapse has been obtained, maintaining same by larger quantities at longer intervals. This method minimizes the danger of reactivation, infection, and febrile reactions. At first low pressures are used, increasing same later on. The duration of the treatment is from six months to two or more years.

Only those expert in artificial pneumothorax should institute it, and then only in carefully selected cases, with constant observations, especially by the X-ray. The latter are of great importance in the selection of cases. Early infiltration should not be so treated. The best results are obtained in the chronic forms, adhesion-free, and unilateral. Splendid results are seen in cavity cases if not extensive or superficial. In severe haemoptysis pneumothorax is strictly obligatory; it stops bleeding quickly, and lessens the danger of aspiration pneumonia or aspiration tuberculosis.

Advanced cases as a rule are not benefited. In bilateral cases especially should caution be used, because acute infiltrations or inflammatory processes on the non-compressed side can easily be aggravated.

Physical examination gives more reliable information than the X-ray regarding adhesions. Indicative of adhesions are marked weakening of breathing over lower lobe, shortening of inspiration (Jacquerod's sign) presence of "dissociation symptom" of Kuthy e. g. pectoral fremitus diminished with increased voice or bronchophy over same dull area, and diminished excursion by percussion.

The X-ray is the best means of studying the condition of the chest after the introduction of gas. However, to detect early damage to the opposite side, the stethoscope must be relied on chiefly. The benefit derived from the treatment is almost in direct proportion to the size of the pneumothorax. In unilateral cases without adhesions, there results arrest and healing of the pathological process. In the presence of adhesions and in bilateral cases the result is symptomatic. Adhesions should be separated slowly.

To prevent accidents during the operation be sure that the needle is in free pleural space and that the manometer registers negative pressure. Many valuable manometric points are given.

Among the complications, cubcutaneous emphysema occurs rarely. The most frequent is hydrothorax. Unless it inconveniences the patient it is best left alone. There were two groups of hydrothorax cases, the first comprising four cases, where it was necessary on account of adhesions to work with high pressure, and tearing adhesions could be ascribed as the cause. Group two comprises four cases, where the effusion was probably due to an extension of a cortical tuberculosis through the pleura. Pyothorax occurred seven times, probably due to perforation of some cortical caseous focus. An unpleasant sequela, which frequently renders further treatment impossible, is the formation of secondary pleural thickening and adhesions. Air embolism occurred once, with full recovery. Recrudescence in the uncollapsed side occurred three times. Pleurisy with effusion in the opposite side happened three times. Pleural eclampsia occurred twice, with complete recovery.

Failures to induce a clinical cure has been due to the independent evolution of preexciting lesions in the other lung or elsewhere, or to pleural adhesions, preventing a satisfactory collapse.—*Clinical Observations of 100 Cases of Artificial Pneumathorax, R. C. Matson, Cal. State J. of M., August, 1917.*

Artificial Pneumothorax.—Most of the pathological changes which occur in artificial pneumothorax are still mooted points. It appears that around the diseased areas there occurs connective tissue proliferation which is dependent in part upon the lymph stasis following artificial pneumothorax. The alveoli of the lung are reduced to little round glandular looking bodies and the alveolar epithelium returns to its fetal cuboidal shape. The bronchi and bronchioles are narrowed or entirely obliterated. Caseous and pneumonic foci show a tendency to scar formation and are surrounded by fibrous tissue. The fluid of the caseous masses is frequently forced into the bronchi, which causes an increase in the amount of expectoration; the remains of these masses are continuously compressed by the connective tissue proliferation, and finally dry up and become

calcified. Cavities, when compressed, are entirely obliterated and surrounded by connective tissue. No fresh tubercles have been found in the compressed lung post-mortem. The question whether the therapeutic results are due to the lymph stasis or to anemia or to a resultant hyperemia (which has been shown by some observers) or to the mechanical rest, is still sub judice. Some attribute the improvement to a lessened absorption of toxin from the compressed lung. The author at times hesitates to compress the left lung when it is the seat of greater involvement since he has seen some bad results from dislocation of the heart and mediastinum to the right. One author advises against compression when there is urochromogen in the urine. Artificial pneumothorax offers much in cases where there is high fever with mixed infection or absorption from large cavities. It is of similar benefit in severe hemoptysis. In miliary tuberculosis, intestinal tuberculosis, in chronic nephritis, and in amyloid disease artificial pneumothorax is contraindicated.

The danger of air embolism can be avoided by withholding the introduction of gas untll the manometer shows definitely that the needle is in the pleural cavity. Pleural shock resembles air embolism, except that the symptoms from the former are milder. It follows the introduction of gas below the body temperature. Another danger is the too rapid displacement of the mediastinum and heart. Pleural effusions may follow lung compression and are as a rule harmless. When the fluid becomes excessive it necessitates aspiration. Superficial and subpleural emphysema is a mild complication due to wrong technic. A thickened and adherent pleura may render the procedure impossible.

The best method of obtaining compression is to give the gas in small quantities and at three to five day intervals. Complete collapse is usually obtained in six to eight injections, the intervals are then gradually lengthened, compression being maintained by monthly injections. The lung is not allowed to reexpand until the symptoms have abated.—*Artificial Pneumothorax in Pulmonary Tuberculosis, S. Simon, N. York M. J., April 21, 1917, cv, no. 16, 734.*

Artificial Pneumothorax.—More than 30 cc. are never injected at one sitting. The advantages of the small injections are: more gradual displacement of the thoracic contents, less marked symptoms, subcutaneous emphysema less frequent, and quiesent processes less apt to be awakened. The injection of gas for the control of bleeding is very efficacious, for that purpose more gas can be injected. In pleural effusion it is best to remove fluid when it reaches the fourth rib, and to substitute for it gas at the time of the withdrawal or shortly after. The great danger at the initial injections is air embolism. This is, however, rare. It can be avoided by having the field of operation the highest point of the chest, and by inserting the needle slowly and steadily till the pleura is reached, not deeper than 3 to 4 cm. When gas pockets have formed, continue the injections, with the hope that adhesions will give way. However failure is generally the case. Partial collapse is often the means of prolonging life and relieving symptoms. Good results are only obtained from total collapse. The duration of collapse should be 18 to 36 months.

Artificial pneumothorax is recommended especially in advanced cases. Sometimes the results are extremely satisfactory. However there may be an awakening of a quiescent focus in the good side, destroying the good results achieved by pneumothorax. The question which presents itself is—will the relatively sound lung hold. Experience, small injections, and frequent examinations are necessary to reach a satisfactory conclusion.—*Some Notes on Artificial Pneumothorax, P. H. Ringer. Boston M. & S. J., July 12, 1917, clxxcii, no. 2, 50.*

Results of Artificial Pneumothorax.—In the past three and a half years thirty patients have been treated by artificial pneumothorax. With the exception of four, they were advanced cases. Collapse of the lung was resorted to in four instances for the purpose of stopping hemorrhage. The results are tabulated as follows: Complete success, 7 cases, or 23.3 per cent; complete success for stopping hemorrhage, 3 cases or 10 per cent; partial success (gas still being given), 2 cases or 6.6 per cent; prolongation of life for an appreciable period of time, 4 cases or 13.3 per cent; failures, 14 cases or 46.6 per cent. If we consider the first two headings together the percentage of successful attempts amounts to 33.3. A number of the patients are still receiving injections, even some of those classed as successful. Seven lives were actually saved, since under a strict dietetic-hygienic regimen no results were obtained and the patients would have unquestionably died. In the four cases where collapse was performed for the stoppage of bleeding success was obtained in all; but one patient had been too exsanguinated to rally. The author strongly advocates pneumothorax for the arrest of

hemorrhage if severe and protracted, and not influenced by medical measures. There were 14 failures; the cause for these is given as: adhesions, 71 per cent; undiscovered disease in the other lung, 14.2 per cent; and development of tuberculous pneumonia in the opposite lung, 1 case or 7 per cent. The conclusion is obvious that artificial pneumothorax as a factor in the treatment of pulmonary tuberculosis has come to stay.—*Analysis of Thirty Cases of Pulmonary Tuberculosis Treated by The Induction of An Artificial Pneumothorax. P. H. Ringer, Am. J. M. Sc., September, 1917, cliv, no. 3, 380.*

Pleural Adhesions in Artificial Pneumothorax.—Pleural adhesions are almost constantly present in pulmonary tuberculosis. Whether they be elastic and recent or resistant and old, it is imperative that their presence and location be recognized before any attempt is made to inject air into the pleural cavity. The apex of the lung is a site of predilection for these adhesions owing to the limited mobility of this part. Physical examination will often reveal their presence. A depresion will often be observed, on inspecting the chest anteriorly, either above or below the clavicle; this is due to adhesions if cavities can be excluded. A localized depression at the base, often accompanied by diminished expansion, is also indicative of pleural adhesions although it must be remembered that any inflammation will also hinder expansion of the chest. Depression of the lower intercostal spaces on deep inspiration with the patient viewed from the side suggest pleural adhesions. At the level of the adhesions the muscular tissues of the chest have a somewhat edematous consistence, and the vocal fremitus and breadth sounds are diminished. The precussion findings are of no value except that there is resistance to the percussing finger when the strokes are heavy. The X-ray and fluoroscopy are of some value and should be employed before practicing artificial pneumothorax. It is sometimes feasible to produce compression by overcoming the resistance of adhesions, or failing this, to produce several sacs with air or gas.—*Clinic of Dr. E. Grenier, read at Canadian M. Ass. Meeting, Montreal, June 13, 1917.*

Tuberculosis Treated by Tuberculin.—There is a remarkable clinical similarity between tuberculosis and syphilis. Cases having no definite symptoms and giving a negative Wassermann, are often benefited, if not cured by a course of tuberculin treatment. These are termed concealed tuberculosis by Head. If the subcutaneous tuberculin test and the Wassermann were tried in every chronic case, before an operation is performed, much information of the greatest possible value to the patient and the operator might be elicited. The tuberculin test, like the Wassermann, should be part in all routine examinations. In this way tuberculous peritonitis, tuberculosis of the prostate, or other concealed tuberculous foci may be discovered and the proper treatment applied.—*Tuberculosis Treated by Tuberculin, R. C. Newton, N. York M. J., Nov. 24, 1917, cvi, no. 21, 965.*

Nasal Insufflation in Tuberculosis.—Paget insufflates dead tubercle bacilli in the form of tuberculin BE into the nose in the neighborhood of the frontal sinuses for therapeutic purposes. The dose of the powder is 0.05 mgm. in severe cases and 0.1 mgm. in ordinary cases. The powder is placed in an angulated glass tube having a wide opening at one end and a narrow opening at the other which is placed in the nostril. The powder is then blown up the nose towards the frontal sinuses by means of a rubber bulb syringe. The treatment is based on the theory that epithelial cells in general have the property of producing antibodies and this property is particularly inherent in the cells lining the upper nasal passages. The reaction which follows this treatment consists of a rise in temperature followed in a few days by a fall to normal, either by crisis or lysis. Simultaneously with the decline in temperature there is improvement in the symptoms and a diminution or disappearance of the physical signs. The applications are repeated every other day in mild cases until the temperature remains normal, which is in such cases about the tenth day. A reaction with insufflations of moderate dosage is an expression of a distinctly enfeebled resistance against the disease and so the procedure can be employed both as a diagnostic and prognostic test. Often there is a congestion of the nasal sinuses, at times causing bleeding, but this is followed by improvement both local and general. The treatment is suitable for pulmonary as well as for glandular and bone tuberculosis.—*Nasal Insufflation in the Diagnosis, Prognosis, and Treatment of Tuberculosis, O. Paget, Med. Rec., Oct. 20, 1917, xcii, no. 16, 668.*

MULFORD
FOR THE CONSERVATION OF LIFE
LABORATORIES

The Choice of Tuberculins

1. **For diagnostic purposes** whether administered by the cutaneous, percutaneous, intracutaneous or subcutaneous method, the original tuberculin of Koch ("O T") is recognized as the standard.*

2. **In the treatment of tuberculosis** the choice of tuberculins should properly be restricted to the preparations of which we have the fullest information.

Based upon this consideration

Old Tuberculin—"O T"
Bouillon Filtrate—"B F"
Bacillen Emulsion—"B E"

meet our present theoretical requirements. Their selection is fully justified by experience, and by advocating their use to the exclusion of other preparations the perplexity of the practitioner in planning a program of treatment of his tuberculous patients may be greatly lessened.*

Mulford Tuberculins

The following Tuberculins are undiluted

Tuberculin, Old ("O T") in 1 Gm. vials	$1 00
Tuberculin, Denys (Bouillon Filtrate, "B F")† in 1 Gm. vials	1 50
Tuberculin "R" (Tuberculin Rest, "T R")† in 1 Gm. vials	1 50
Tuberculin, Bacillen Emulsion ("B E"), in 1 Gm. vials	1 50
Moro Reaction, Tuberculin ointment for Moro cutaneous reaction. In 1 Gm. tubes, 4 tests to the tube	1 00
Von Pirquet Test. Tuberculin, Old. In packages of one capillary tube with control	25
In packages of 3 capillary tubes	65
10 capillary tubes with control	1 25
Intradermal Tuberculin Mulford	
In intradermic syringes, single test packages	75
In intradermic syringes, 5-test packages	2 50
In vials of 50-test packages	12 50
Tuberculin Scarifier, similar to that used by von Pirquet	50
Syringes, for administration of Bacterial Vaccines and Tuberculins. All glass with two needles	1 50

TUBERCULIN DILUTIONS

Single vials of Serial Dilutions "O T," "B F," "T R" or "B E"	50

We Also Furnish

Proteose Free Tuberculin, i.e., "O T," from which the proteins have been precipitated by alcohol.

Old Tuberculin Precipitate ("O T P") "O T" precipitated by alcohol and redissolved in salt solution, reprecipitated by alcohol and dried in vacuum and powdered—used for the ophthalmic tuberculin reaction for cattle.

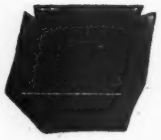
* "The Choice of Tuberculins," by Benjamin White, Otisville, N. Y., Department of Health, City of New York. Read at the annual meeting of the Medical Society of the State of New York, at Saratoga Springs, May 18, 1916.

† Human or bovine type.

Literature sent on request

H. K. MULFORD CO., Philadelphia, U. S. A.

25768 **Manufacturing and Biological Chemists**



HYGIENIC PAPER SPECIALTIES

Paper Sputum Cups and Holders—Pocket Sputum Cups—Paper Cuspidors—Paper Napkins—Paper Towels—Drinking Cups

STONE & FORSYTH CO. **Boston, Mass.**

PRESCOTT, ARIZONA ALTITUDE 5350 FEET

PAMSETGAAF SANATORIUM

FOR TUBERCULOSIS

Pamsetgaaf is a quiet cottage sanatorium for the treatment of all forms of tuberculosis. It is beautifully situated among the pines in the mountains of Northern Arizona, and offers all the advantages of careful scientific treatment combined with the pure invigorating air of the Southwest in the midst of attractive surroundings. Especial facilities for surgical tuberculosis. Write for illustrated booklet.

JOHN W. FLINN, Medical Director

BACK NUMBERS—WANTED

We Will Pay 35 Cents Each

for copies of The Review for March, April and May, 1917. If you have any copies of these numbers that you wish to spare, forward them immediately.

The American Review of Tuberculosis

105 East 22d Street **New York City**

A Mountain Sun Bath

THE healing and curative effect of sunlight at very high altitudes has long been known. How to secure the same effect at low altitudes of great atmospheric density has long been a problem. The HERAEUS SUN LAMP solves it—enabling the Physician or Dermatologist to concentrate on obstinate cases a light rich in ultra-violet rays—without undue heat and free from scarification dangers, even after sustained application.

Has the same value as systematic heliotherapy with the added advantages of convenience, economy and ease of operation. Used in leading Hospitals, Sanatoria and in war-zone base hospitals.

HERAEUS SUN LAMP & KROMAYER LAMP

HANOVIA CHEMICAL & MFG. CO.

NEWARK NEW JERSEY

NEW YORK OFFICE CHARLES ENGLEHARD, 30 CHURCH ST.

Send for Book No. 50C on Heliotherapy and the Heraeus Sun Lamp—*FREE.*

THE **SPRINGFIELD OPEN AIR COLONY**

A SANATORIUM AND SCHOOL FOR THE TUBERCULOUS WHERE **HAPPINESS** IS REGARDED AN ABSOLUTELY ESSENTIAL PART OF TREATMENT

NOT AN INSTITUTION.
NOT A HOSPITAL.
NOT A LABORATORY.
NOT A SCIENTIFIC WORKSHOP.

¶ A SANATORIUM WITH A PERSONALITY WHICH RECOGNIZES THE PERSONALITY OF THE PATIENT.

¶ NO MORE PATIENTS ACCEPTED THAN CAN RECEIVE THE CONSTANT PERSONAL ATTENTION OF THE MEDICAL DIRECTOR.

¶ RATES LOWER THAN ANY OTHER MID-WESTERN SANATORIUM GIVING THE SAME QUALITY OF INDIVIDUAL SERVICE.

Circular on request

GEORGE THOMAS PALMER, M.D.
Director
SPRINGFIELD, ILLINOIS

CALCREOSE

The therapeutic value of creosote is well known and has long been recognized. Its use has been neglected largely because of the difficulties of administration.

Calcreose, a chemical combination of creosote and calcium (contains 50% creosote) overcomes many of the objections.

Calcreose is of value in the treatment of bronchitis, especially the bronchitis associated with pulmonary tuberculosis, and gastro-intestinal infections.

As high as 120 grains of Calcreose has been given daily without digestive disturbance.

Literature and samples supplied, to physitions only, upon request.

THE MALTBIE CHEMICAL CO
PHARMACEUTICAL CHEMISTS
NEWARK NEW JERSEY

TWO IMPORTANT BOOKS

Fishberg's Pulmonary Tuberculosis

This monograph is a sane presentation of the tuberculosis problem of today. It is at once highly authoritative and intensely practical. Emphasis is laid on the fact that in most cases the patient can be given the benefit of rest, fresh air and proper food in his home as well as in an institution. Medicinal treatment is not neglected, and artificial pneumothorax has been given in detail.

Octavo, 639 pages, with 91 engravings and 18 plates. By Maurice Fishberg, M.D., Clinical Professor of Tuberculosis, University and Bellevue Hospital Medical College; Attending Physician, Montefiore Home and Hospital for Chronic Diseases, New York. Cloth, $5.00 Net.

Lord's Diseases of the Bronchi, Lungs and Pleura

One of the best features of the book is the excellent subdivision of the subject-matter; rare conditions are adequately and thoroughly discussed, but always with due regard to their frequency and importance. The author presents current knowledge of the diseases of the respiratory organs and supplements this with a large personal experience. The form of presentation is clear and concise and the book can be heartily recommended as an authoritative exposition of the subject.

Octavo, 606 pages, with 93 engravings and 3 colored plates. By Frederick T. Lord, M.D., Instructor in Clinicl Medicine, Harvard Medical School; Visiting Physician, Massachusetts General Hospital and Channing Home for Consumptives, Boston. Cloth, $5.00 net

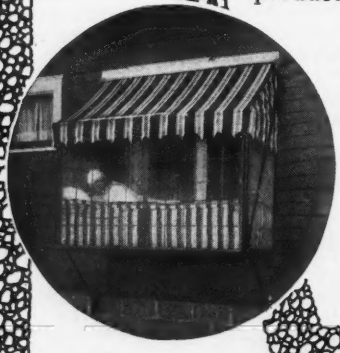
PHILADELPHIA
706-8-10 Sansom Street

LEA & FEBIGER

NEW YORK
2 West 45th Street

Fresh Air Is The Best Medicine

KORFF
Sleeping Porch



Outdoor sleeping is particularly beneficial for indoor workers, tubercular patients, and for adults or children afflicted with insomnia, nervous diseases and malnutrition.

It increases the oxygen in the blood, brings refreshing rest and induces a natural appetite and the proper assimilation of food. Any doctor will tell you that outdoor sleeping generally produces a marked improvement in the health of a patient.

The KORFF Sleeping Porch, which hangs outside the bedroom window, is the most convenient method of sleeping out of doors. NO DRAFTS. Strong and thoroughly screened and curtained. Dress and undress in your own room. Easy to erect. Can be attached to any house. The cost is very reasonable.

Write for big, illustrated FREE folder.

KORFF MFG. CO.
317 East Franklin Ave., Lansing, Mich.

BOUND VOLUMES

Arrangements are being made for binding the first volume and succeeding volumes of The Review in attractive uniform style in good, strong, serviceable buckram binding, properly stamped and lettered.

Bound volumes will be sold for $1.00 on receipt of a full set of copies for the current year. If no copies are furnished, price of bound volumes will be $4.00.

ORDER NOW

The American Review of Tuberculosis

105 East 22nd St. New York City

Order Your **REST-EZY**

Collapsible Recliner To-Day!

$19.50

Complete with Magazine Rack

Reading Rack $5.00 Extra

Only Recliner that folds easily for shipping or storing. Satisfaction guaranteed or money refunded.

Our own model; in Mission style, strong and serviceable. Eight legs have ball-bearing casters. Wide right arm extends enough to make good writing board. Fifty-six coiled springs throuout, including back, all attached, strong and substantial. Back-adjuster enables occupant to automatically adjust the back-rest to eight different positions. Serviceable cushions, designed especially for these chairs.

LARGE 1918 CATALOG Illustrating Adirondack Outfittings for men, women and children **SENT FREE**

W. C. Leonard & Co. 144 Main Street, Saranac Lake, N. Y.

PNEUMOTHORAX TREATMENT OF PULMONARY TUBERCULOSIS

By Clive Riviere, M.D., F.R.C.P. Physician

City of London Hospital for Diseases of the Chest

A New Publication by Oxford University Press

Dr. Riviere has performed a real service in bringing together under one cover in concise form the best information available concerning the use of artificial pneumothorax. His book deals with the mode of action of artificial pneumothorax; indications and contraindications for the use; apparatus required; technique of initial operations; effect of pleural adhesions; partial and complete pneumothorax; refills; physical signs in artificial pneumothorax; course of treatment and its termination; effect of pneumothorax on thoracic organs; pleurisy as a complication; gas replacement; accidents of pneumothorax treatment; general results to be expected; and bibliography.

"Dr. Riviere crams a mass of useful information into small space."—British Medical Journal.

Cr. 8vo. Pp. XVI + 186. 2 plates and 10 illus.

Price: $1.75 Postpaid

If ordered from JOURNAL OF THE OUTDOOR LIFE

289 FOURTH AVENUE, NEW YORK

Sherman's Bacterial Vaccines

Preparations with a Record for Reliability

THE NON-VIRULENT T. B. VACCINE

For use in

TUBERCULAR INFECTIONS

Write for Literature

MANUFACTURER OF BACTERIAL VACCINES

G. H. SHERMAN, M.D.

Detroit, Mich. U.S.A.

DAILY USERS OF VACCINES USE SHERMAN'S